THE EFFECT OF DIGITAL WORD STUDY ON FIFTH GRADERS' VOCABULARY ACQUISITION, RETENTION, AND MOTIVATION: A MIXED METHODS APPROACH

by

Lindsay Sheronick Yearta

A dissertation submitted to the faculty of
The University of North Carolina at Charlotte
in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in
Curriculum and Instruction

Charlotte

2012

Approved by:

_____
Dr. Karen Wood

_____
Dr. Bruce Taylor

_____
Dr. Lynn Alghrim-Delzell

_____
Dr. Bob Rickelman

ABSTRACT

LINDSAY SHERONICK YEARTA. The effect of digital word study on fifth graders' vocabulary acquisition, retention, and motivation: A mixed methods approach. (Under the direction of DR.KAREN WOOD)

Vocabulary and comprehension are so inextricably linked that it ensures the necessity of researchers and teachers to determine the most effective method of vocabulary instruction. Our nation's children are still victims of what has been termed the *vocabulary gap* (Biemiller & Boote, 2006). This vocabulary gap, according to a large body of research (Chall, Jacobs, & Baldwin, 1990; Chall & Jacobs, 2003; Hart & Risley, 1995), is largely attributed to students' socioeconomic status. With the increasing digitization of education and proliferation of technology in our culture, students are gaining access to additional learning tools (Collins & Halverson, 2009). Vocabulary is a dimension of education that can be mediated through digital tools such as the Internet. With a global emphasis on the development of 21st century skills, researchers and teachers need to explore new, digital means of teaching vocabulary. The purpose of this study was to explore an alternative method of vocabulary instruction, using digital technologies. The expectation was that digital vocabulary instruction possessed the potential to contribute a means to address the vocabulary gap and provide all students with the mediating tools to improve their vocabularies. This study took place over eight-weeks during the spring semester of 2012 and used a mixed-methods design. Participants included two fifth grade teachers and 43 fifth grade students. The intact classes each had access to two types of vocabulary instruction on Greek and Latin roots: a digital word wall and a non-digital word wall. Group A began instruction with

the digital word wall; group B began instruction with the non-digital word wall. At the end of a three week period, the instructional methods were switched and group A was instructed with the non-digital word wall while group B was instructed with the digital word wall. The study took place in a public elementary school located in a suburban area outside of a large city in the southeastern United States. The students learned three new Greek and Latin roots or prefixes per week. Interviews with students and teachers were conducted and thematically analyzed. A two-way repeated measures ANOVA was used to determine significant differences in students' vocabulary growth as was measured by multiple assessments. While further research is needed, an analysis of the data indicates that the digital word wall is a viable vocabulary instructional method to be added to teachers' repertoires.

ACKNOWLEDGEMENTS

Although I have a great passion for writing, I put off composing the acknowledgements for as long as I possibly could. The support and guidance that I was selflessly given by so many was priceless. I have delayed putting pen to paper, for the purpose of thanking those involved, because I know that the words, heartfelt as they may be, will fail to do my gratitude justice. Please know that all those involved in this process have been integral to my success. Thank you, truly, from the bottom of my heart. This great debt of gratitude is owed to quite a few people: my family, my committee members, and my colleagues.

I have great appreciation for my family members who provided significant support throughout the dissertation process. Charles, you made this happen. You never gave up on me nor did you allow me to give up on myself. You picked up the slack in our household so that I could have additional time to write. Grace, you often gave me the strength that I needed to continue. I wanted to be successful in this endeavor so that I might provide a good example for you to follow. Never give up on your dreams, daughter of mine. Uncle Joe, thank you for telling me that I could be anything I wanted to be. I believed you. Mom, Dad, Megan, Kassem, Aaron, Jennifer, Aunt Nancy, and Stephanie you fielded numerous phone calls, watched Grace when needed, and always helped ease the stress. Thank you so much.

To my wonderful committee members, thank you for everything. Karen, you were an excellent chair. You pushed me to compose better drafts and were always available when I needed you most. Bruce, you were an integral part of this process. You enabled me to make it to the finish-line without losing my spirit. Thank you for

reading, editing, and providing invaluable feedback on countless drafts. Lynn, your feedback was instrumental as well. Thank you for your significant guidance, especially in the research portion of the dissertation. Bob, thank you for your feedback, particularly in the early drafts. The four of you were a superior committee and I consider myself very lucky for having had the chance to work with you all.

I would not have been able to conduct the study, as a full-time classroom teacher, without the support of my colleagues and administrators. I learned so much from you all and our students throughout this process. I consider myself fortunate to have had the opportunity to work with such phenomenal educators.

Again, I know that this dissertation would not be here if it were not for the support and guidance of many people in my life. You all are truly appreciated. "Namaste."

TABLE OF CONTENTS

LIST OF TABLES

LIST OF GRAPHS

CHAPTER 1: INTRODUCTION

"The importance of vocabulary is daily demonstrated in schools and out. In the classroom, the achieving students possess the most adequate vocabularies. Because of the verbal nature of most classroom activities, knowledge of words and the ability to use language are essential to success in these activities. After schooling has ended, adequacy of vocabulary is almost equally essential for achievement in vocation and in society."
-Petty, Herold, and Stoll (1967, p. 7)

Although the words of Petty, Herold, and Stoll (1967) were written over 40 years ago, the importance of their message remains unchanged. The acquisition of vocabulary is critical to students' success. An inadequate vocabulary can hamper students' achievement within the classroom as well as within the larger context of the world. Furthermore, an insufficient vocabulary is linked to poor reading comprehension (Cunningham & Stanovich, 1997; National Center for Reading First Technical Assistance, 2008).

In accordance with this understanding, struggling readers have long captured the attention of researchers (Kamil, Borman, Dole, Kral, Salinger, & Torgensen, 2008; Rupley & Nichols, 2005; Taylor, Mraz, Nichols, Rickelman, Wood, 2009; Wanzek, Wexler, Vaughn, Ciullo, 2010). Although many researchers have devoted countless hours to improving the skills of struggling readers, data has repeatedly shown that students continue to perform poorly on measures of reading (National Center for Education Statistics [NCES], 2012). The most recent administration of the National Assessment of Educational Progress (NAEP) has shown a trend of stagnation for fourth

graders in what Chall and Jacobs (1983) have termed the “fourth grade slump.” In fact, the percentage of fourth grade students scoring below basic levels of reading has remained unchanged since 2007 (NCES, 2012). The outlook is not much brighter for eighth graders. While eighth graders’ reading scores have increased, it has not been significant. The percentage of eighth grade students scoring at a basic level or higher of reading has increased a mere two points since 2007 (NCES, 2012). The National Center for Education Statistics (NCES) reported that in 2011, 33% of fourth graders and 24% of eighth graders scored below basic in reading. While these statistics may seem daunting, they are indicative of the dire need for further study in the realm of reading instruction.

Taken as a whole, reading is an incredibly nuanced and complicated subject to study. However, the National Reading Panel has identified five distinct components of reading which can be studied individually: vocabulary, comprehension, phonemic awareness, phonics, and fluency (National Institute of Child Health and Human Development [NICHD], 2000). The present study focused on vocabulary instruction as one area of reading which, if improved, could aid in dispelling the fourth grade slump. The following section details the close connection between vocabulary and reading comprehension.

Vocabulary and Reading Comprehension

As if the National Reading Panel identifying vocabulary as a component of reading were not enough to warrant additional study of vocabulary instructional methods, there is an exorbitant amount of research that closely links vocabulary knowledge and reading comprehension (Anderson & Freebody, 1981; Anderson &

Freebody, 1985; Beck, McKeown, & Kucan, 2002; Graves, 2004; NICHD, 2000; RAND Reading Study Group, 2002; Snow, Burns, & Griffin, 1998). Students with strong vocabularies tend to comprehend higher level texts. Reciprocally, students who have lesser vocabularies struggle to comprehend or learn from texts (Anderson & Nagy, 1992; National Center for Reading First Technical Assistance, 2008). Not only is it important for students to comprehend specific texts, but it is also vital that students develop strategies to foster their independent comprehension strategies (Blachowicz & Fisher, 2006).

Vocabulary knowledge is a substantial indicator of a student's reading comprehension level (Cunningham & Stanovich, 1997). Specifically, Cunningham and Stanovich (1997) found that oral vocabulary at the end of first grade is a highly significant predictor of comprehension ten years later. Their study involved a mixed group of first graders, most of whom they followed through the eleventh grade. Rupley and Nichols (2005) also focused on struggling readers and reported data that supported the claims of Cunningham and Stanovich (1997). Rupley and Nichols (2005) found that struggling readers seldom make significant gains in reading comprehension due in large part to their limited reading vocabulary.

While a causal relationship has never been established, vocabulary and reading comprehension are clearly linked (Anderson & Freebody, 1981; Anderson & Freebody, 1985; Cunningham & Stanovich, 1997; Rupley & Nichols, 2005). Due to this relationship, it can be asserted that students can benefit from additional research-based approaches to vocabulary that involve comprehension as opposed to approaches that focus solely on word study. One instructional method which should be examined with

regards to vocabulary instruction is digital vocabulary. With the increasing emphasis on technology in the classroom and at home, the use of digital tools as a means of improving vocabulary knowledge has merit and potential.

Technology and Digital Vocabulary

Stahl and Nagy (2006) have found that as the level of technological advances continues to escalate, so does the level of literacy needed in order to be able to fully participate in society. In order for students to become proficiently literate in today's world, they must also become proficient in the new literacies of 21st century technologies (International Reading Association [IRA], 2009). America's literacy needs are increasing (IRA, 2009; Stahl & Nagy, 2006). The world is changing; therefore, teachers need to prepare their students for the technological realm of being and learning in the 21st century (Collins & Halverson; 2009; Richardson, 2006). Accordingly, technology is becoming more relevant in schools (Collins & Halverson, 2009; Friedman, 2007; Richardson, 2006). Furthermore, technology provides educators with innovative and improved opportunities to educate students (Collins & Halverson, 2009; Friedman, 2007; Richardson, 2006).

An area of technological innovation, which can be examined more closely, is digital vocabulary instruction. Digital vocabulary instruction includes, not only the increasingly important digitization aspect of learning (Collins & Halverson, 2009; Narkon, Wells, & Segal, 2011), but also the importance of expanding our view of vocabulary instruction to include what Wood, Harmon, and Taylor (2011) have termed "vocabulary literacy." Wood, Harmon, and Taylor (2011) coined the term vocabulary literacy in order to describe vocabulary instruction that encompasses the multiple

dimensions of “reading, writing, listening, speaking, and visually representing” (p. 7). Making the leap into the 21st century of learning allows researchers, teachers, and students access to innovative instructional tools. Web 2.0 tools such as wikis, downloadable clipart, photographs, online dictionaries, and digital thesauruses are available to mediate learning and provide ample opportunities for students. Providing students with the technological tools, such as wikis, encourages collaboration and can augment learning (Narkon, Wells, & Segal, 2011). Using technology during literacy instruction can enhance student learning opportunities and outcomes (Herbert & Murdock, 1994; Koppenhaver & Erickson, 2003; Moore & Calvert, 2000; Narkon, Wells, & Segal, 2011).

Collins and Halverson (2009) found that using technology in the classroom does present some difficulties for teachers. First of all, using technology in the classroom requires that teachers have control of new and often untaught skills (Cisco Systems, 2006; Collins & Halverson, 2009). Second, teachers may employ a rigid approach to education where individualizing education for each student becomes quite a difficult task. The third difficulty that Collins and Halverson (2009) discuss is that teachers can feel undervalued when students have access to the immense resources of the Internet. Teachers in this study were provided with professional development so that some of the aforementioned difficulties might be reduced. This professional development focused on providing the teachers with direction on how to use the digital and non-digital word walls in their classrooms. The International Reading Association (IRA) (2009) published a position statement on new literacies and 21st century technologies in which

they touted the necessity of having professional development embedded within the schools. Merely having the technology present is simply not enough (IRA, 2009).

In addition to educating the teachers in this study about the positive effects of technology in the classroom, the researcher also hoped to demonstrate the positive effects of collaboration, allowing students work together in order to learn vocabulary (Allen, 1999; Arter & Nilsen, 2009; IRA, 2009). The collaborative nature of learning was supported through the use of the wikis in this study. Students were able to collaborate in order to collectively construct the digital word wall.

Statement of the Problem: The Widening Vocabulary Gap

While closing the "achievement gap" has been a focus of many administrators and teachers recently, Biemiller and Boote (2006) have found that schools are not doing enough to close the *vocabulary gap*. Although vocabulary is a vital aspect of reading instruction, it is often neglected in schools today (Berne & Blachowicz, 2008; Biemiller & Boote, 2006). This neglect causes the vocabulary gap to widen (Biemiller & Boote, 2006). Closing this gap can and should entail providing students with vocabulary acquisition skills and numerous vocabulary experiences in the classroom. There are several key points to consider when analyzing the widening vocabulary gap: (1) environmental factors impact vocabulary acquisition, (2) researchers are unable to agree on the best approach for vocabulary instruction, and (3) teachers are often unable to adequately address vocabulary instruction within their classrooms. As Coyne, Kame'enui, and Carnine (2007) found, "The learning characteristics that have the strongest causal connection to academic failure are rooted in the area of language" (p.

38). While vocabulary is merely a portion of the broad construct of language, it is nonetheless an important topic to research (Ebbers & Denton, 2008).

Environmental factors. According to several researchers, the size of students' vocabulary levels can be correlated with environmental factors such as parent education and quality of the environment (Graves, 2009; Hall, Nagy, & Linn, 1984; Wells, 1986). Students enter school with significantly different levels and sizes of vocabularies, often aligned closely with the students' socioeconomic status (Chall, Jacobs, & Baldwin, 1990; Chall & Jacobs, 2003; Hart & Risley, 1995). As the socioeconomic (Hart & Risley, 1995) as well as racial and ethnic (NCES, 2009) gaps persist, it remains imperative that researchers and educators find a way to lessen the vocabulary and reading comprehension gap. As the NICHD (2000) has noted, "While much is known about the importance of vocabulary to success in reading, there is little research on best methods" (p. 17). This study seeks to add to the repertoire of research by determining additional instructional methods specifically related to technology to improve students' vocabulary acquisition and retention.

The typical student enters school with a relatively small reading vocabulary, and this knowledge of words usually grows quite significantly; the growth is most often estimated to be around three to four thousand words a year (Nagy & Anderson, 1984). This vocabulary acquisition rate can result in a student being in possession of 25,000 words by the end of the student's eighth grade year and 50,000 words at the culmination of high school (Anderson & Nagy, 1992; Graves, 2004; Nagy & Anderson, 1984; White, Graves, & Slater, 1990). Students who begin school with less vocabulary knowledge than their peers are typically unable to catch up (Graves, 2009; Hart &

Risley, 1995). Not only do students fall behind their peers, but the gap between the students with substantial vocabularies and the students with poor vocabularies continues to widen as the students progress through school (Graves, 2009; Hart & Risley, 1995). It is evident from this research that the gap between the vocabularies of the students from varying socioeconomic groups must be narrowed.

Students from lower socioeconomic status households typically have smaller vocabularies than their wealthier peers and can also have significant difficulties learning vocabulary in later years (Graves, 2009; Hall, Nagy, & Linn, 1984). In the early 1990s, Hart and Risley (1995) conducted a research study in which they observed and recorded the experiences of ordinary one and two year olds. The term ordinary in Hart and Risley's (1995) study was indicative of children who performed reasonably well in school and who had parents who were of average socioeconomic status. The study was conducted for more than two years and focused on the children's interactions and surroundings as they began learning to verbalize thoughts and actions (1995). Hart and Risley found that students enter school with significant differences in vocabulary knowledge, which was attributed to the differences in socioeconomic status of the students' families. For instance, the average number of words which were spoken or addressed to the children by parents was clearly delineated according to socioeconomic status. Professional parents addressed the most significant amount of words to their children, working class parents addressed the second most number of words to their children, and the six welfare families that participated in the study addressed the least number of words to their children (Hart & Risley, 1995). This difference was manifested in a large gap of student performance and vocabulary acquisition in

elementary school (Hart & Risley, 1995). The discrepancy rarely dissipates; in fact, the gap in vocabulary knowledge between the best and the struggling readers grows larger as the students progress through school (Graves, 2009; Hart & Risley, 1995) and is a substantial obstacle to success in reading (Biemiller, 2001; Hart & Risley, 1995; NICHD, 2000; RAND Reading Study Group, 2002).

Additional studies of low socioeconomic students falling behind their wealthier peers have been conducted with similar findings. When studying why and how poor students fall behind their wealthier peers in school, Chall, Jacobs, and Baldwin (1990) and later Chall and Jacobs (2003) found that low socioeconomic status students begin to fall behind in the fourth grade. In fact, fourth grade demonstrates no growth in the area of reading, according to the National Report Card (NCES, 2009). Moreover, the vocabulary gap persists as the students continue to fall further behind in grades five and six (Chall, Jacobs, & Baldwin, 1990; Chall & Jacobs, 2003). The first and strongest factor to begin to decline was the students' word knowledge (Chall, Jacobs, & Baldwin, 1990; Chall & Jacobs, 2003).

Multiple approaches: Which is best? There are many different viewpoints on the best instructional approaches to improve students' word knowledge and lessen the vocabulary gap. Researchers tend to align themselves with one of three distinct stances on vocabulary instruction. Some researchers, especially those who study students with learning disabilities or struggling students, believe that direct instruction is necessary (Bryant, Goodwin, Bryant, & Higgins, 2003; Edwards, Font, Baumann, & Boland, 2004; Graves, 2004;Taylor et al, 2009). Biemiller (2001) found that 80% of the acquired vocabulary of typical sixth graders was learned through direct instruction. On

what could be called the opposite end of the spectrum, some researchers believe that wide reading is an excellent way to allow students to incidentally learn vocabulary words (Nagy & Anderson, 1984; Nagy, Herman, & Anderson, 1985). Positioned firmly in the middle are the researchers who believe that the best vocabulary instruction comes from a mixture of direct instruction and wide reading (Allen, 1999; Arter & Nilsen, 2009). Allen (1999), a former proponent of direct instruction, found herself unhappy with the results of the traditional method of teaching vocabulary. This method often entails assigning words on Monday, practicing through Thursday, and testing on Friday (Allen, 1999), and it typically results in a superficial level of knowledge (Nagy, 1988). Allen (1999) found that the traditional approach did not appear to have a positive academic outcome with her students. She then thought it best to try a different approach. At that point she solely stressed wide reading in her classroom with the intent of increasing her students' vocabularies (Allen, 1999). However, as many teachers often do, Allen later discovered the importance of direct, explicit instruction as well as the importance of specific time devoted to vocabulary instruction. Allen's (1999) current stance on vocabulary instruction is that the explicit instruction must meet the needs of the students and should not be the traditional, pre-packaged vocabulary system because the traditional systems tend to be completely irrelevant to vocabulary growth and often just serve to increase the vocabulary gap.

Cunningham and Stanovich (1997) found that an additional limitation to employing only wide reading in a classroom for the purpose of enabling students to learn vocabulary is that most students who are in the greatest need of vocabulary instruction do not read often and seldom come in contact with unfamiliar words. When

those students come in contact with unknown words, they get so bogged down in trying to decipher the meaning of individual words that they often lose comprehension (Cunningham & Stanovich, 1997). This phenomenon is known as the "Matthew Effect" and is often discussed in terms of "the rich get richer and the poor get poorer" (Cunningham & Stanovich, 1997, p. 934). If these students do come in contact with unknown words they typically lack the skills needed to infer meaning, due in large part to their lack of wide reading (Beck, McKeown, & Kucan, 2002).

Lack of adequate vocabulary instruction in the classroom. There are teachers in the United States today who are failing to adequately address vocabulary instruction (Beck & McKeown, 2007; Stahl & Nagy, 2006; Zutell, 2008). Stahl and Nagy (2006) attribute this to two possibilities. First, some teachers view vocabulary and other reading instruction as an "either/or" instead of a "both/and" (p. 7). This means that some teachers are focusing on other aspects of reading instruction instead of vocabulary or solely focusing on vocabulary instruction instead of addressing any other areas in reading instruction (when they should be addressing both). For example, a teacher might be instructing her students on detecting bias in literature instead of instructing her students in vocabulary *and* detecting bias in literature. Second, there are teachers who think of vocabulary instruction in terms of the traditional methods previously explained in this chapter, and these teachers refuse to teach vocabulary due to the proven ineffectiveness of the traditional methods (Stahl & Nagy, 2006). Berne and Blachowicz (2008) also found that some teachers negate the teaching of vocabulary completely. The teachers in the Berne and Blachowicz (2008) study cited the following reasons for not teaching vocabulary: the school day goes by too quickly, the other content areas must

take precedence, and the teachers felt that the students were unable to learn the words even with vocabulary instruction.

In addition to teachers who fail to adequately address vocabulary instruction or fail to teach vocabulary altogether, there are teachers who continue to subject their students to what has been termed traditional vocabulary instruction (Zutell, 2008). This can entail completing exercises in a manufactured, commercial vocabulary book (Zutell, 2008) or simply memorizing words and definitions (Nichols & Rupley, 2004; Stahl and Nagy, 2006). As mentioned previously, traditional instruction tends to involve surface teaching and learning of vocabulary terms (Allen, 1999). Nagy (1988) found the practice of traditional instruction, insofar that students follow the antiquated practices of writing write definitions, quite ineffective. Allen (1999) found these practices ineffective for two main reasons: a word can have multiple meanings in different contexts and students can have many difficulties understanding the definition well enough to be able to use the word in their own speaking and writing.

Although there are teachers that find it inconvenient or unnecessary to teach vocabulary, the NICHD (2000) published in its *Report of the National Reading Panel* that vocabulary growth is and has been a vital part of literacy and learning. Therefore, this research study addressed the vocabulary gap by studying the effects of a non-traditional, digitized method of instructing students in vocabulary.

It is vital that our educational system quickly take on the task of improving vocabulary instruction (Beck, McKeown, & Kucan, 2002) so that both our successful as well as our struggling students may benefit from vocabulary instruction. It is only then

that educators can hope to minimize the negative impact of what Biemiller and Boote (2006) have termed the vocabulary gap.

Research Purpose and Questions

The purpose of this study was twofold. The first purpose was to determine if digitizing the word wall was a more effective vocabulary instructional method than the non-digital word wall in enabling students to acquire and retain vocabulary knowledge. The second purpose was to provide teachers with an additional instructional tool for engaging students in vocabulary learning.

The following questions provided a framework as well as a direction for this study:

1. What effect does the use of a digital word wall have on students' vocabulary acquisition when compared to the use of a non-digital word wall?
2. To what extent do students retain knowledge of the vocabulary words when using the digital word wall when compared to using the non-digital word wall?
3. What are teachers' and students' perceptions of the digital word wall? Specifically, to what degree is the digital word wall considered an engaging, motivating tool for acquiring and retaining vocabulary?

Significance of the Study

This study examined: (1) the effects of a digital word wall on fifth grade students' acquisition of Greek and Latin roots, (2) the effects of a digital word wall on fifth grade students' retention of Greek and Latin roots, and (3) the students' and teachers' perceptions of the digital word wall. This study was important to conduct for

several reasons. First of all, students' vocabularies must improve. Second, teachers need additional instructional tools to add to their repertoires.

Although educators and researchers know words to be an incredibly powerful and essential aspect of communication, vocabulary instruction is in need of further research (Baumann & Kameenui, 1991). As previously mentioned, research details that students begin to fall behind in grades five and six and that word knowledge is the first facet of reading to decline (Chall, Jacobs, & Baldwin, 1990; Chall & Jacobs, 2003). As Halliday (1993) succinctly wrote, "language is the essential condition of knowing, the process by which experience *becomes* knowledge" (p. 94; emphasis in original). Therefore, improving students' vocabularies is essential to academic success (Beck, McKeown, & Kucan, 2002).

In addition to learning words and meanings in order to improve vocabularies, it is important acquire these skills in order to increase comprehension and learning (Manzo, Manzo, & Thomas, 2006; Robb, 2009). Understanding texts is essential in order for students to be successful and reach high levels of achievement in all content areas (Wood, Harmon, & Taylor, 2011). One way to better enable to students to have higher levels of reading comprehension is to enrich students' vocabularies (Manzo, Manzo, & Thomas, 2006). Many researchers have found that vocabulary knowledge and reading comprehension are closely linked (Anderson & Freebody, 1981; Anderson & Freebody, 1985; Beck, McKeown, & Kucan, 2002; Graves, 2004; NICHD, 2000; RAND Reading Study Group, 2002; Snow, Burns, & Griffin, 1998).

Teachers need additional tools to support vocabulary instruction as the aforementioned traditional methods have been proven ineffective (Nagy, 1988).

Currently, teachers and students now have access to 21st century digital tools (Dreon, Kerper, & Landis, 2011; Richardson, 2006). This study focused on using digital tools in the classroom to improve vocabulary acquisition, retention, and motivation of fifth grade students.

Furthermore, teachers are in need of vocabulary instructional tools because words are so powerful. Graves (2009) retold the story of Helen Keller figuring out that "water" was the liquid running over her hands while she stood at the water pump. Keller was able to make this discovery with the help of her tutor finger-spelling "water" into her hand. That singular moment began a snowball effect: Keller graduated college, became an author, and received the Presidential Medal of Freedom. Learning words and gaining the ability to communicate opened up Keller's world. Without words, humans lose the ability to communicate with one another as well as the ability to build understanding and knowledge (Wells, 2000).

While teachers may be aware of the importance of teaching vocabulary in schools, many teachers cite their uneasiness with vocabulary instruction as well as their lack of information on where to begin and how to teach vocabulary as reasons to negate vocabulary instruction altogether (Berne & Blachowicz, 2008). However, Nagy and Anderson (1984) have estimated that in the fifth grade, students come in contact with 10,000 new words while reading. This large number illustrates the importance of quality vocabulary instruction in the upper elementary levels. Due to the large number of words students come in contact with, teachers often struggle with choosing which words to teach (Beck, McKeown, & Kucan, 2002). An efficient way to instruct students in vocabulary is to teach the meanings of Greek and Latin roots as that instruction should

enable students decipher the meanings of many other words (Rasinski, Padak, Newton, & Newton, 2011).

This study has the potential to guide elementary vocabulary instruction. It could also influence instruction on a large level by providing researchers and teachers with additional instructional tools. Moreover, this study has the potential to impact student and teacher learning at the local level due to the teachers and students involved in the study.

Definition of Terms

The defining of terms is to ensure that the reader can understand relevant terms in the study. The following definitions are in alphabetical order.

Digital Word Wall- For the purpose of this study, a digital word wall is a word wall (see definition of "word wall" below) on an online source. Students are able to manipulate this word wall digitally, from any computer. Pbworks.com, a common, free to educators wiki, was used for this study. Students will have access to the wiki (online collaborative website) from home and from school.

Interactive White Board- An interactive white board can be described as a large, touch screen version of the computer monitor (Lisenbee, 2009). After calibrating the board, a finger or a digital pen may be used to write, draw, or manipulate items on the screen. The words and illustrations appearing on the screen can be saved and viewed at a later time (Lisenbee, 2009).

Non-digital Word Wall- For the purpose of this study, the non-digital word wall is a word wall (see the definition of the " word wall" below) in which students are actively involved in choosing words (the Greek and Latin root words in this study will be finite;

however, students will self-select words which contain the root. For example, if the root is *co*, the student may choose *coworker* as a word to illustrate, define, and otherwise explore), choosing illustrations to represent the word, as well as choosing contextual situations for the words. The creators of the conceptual interactive word wall, Harmon et al. (2009), describe the wall as having the potential for augmenting vocabulary learning for all students as they engage in "activities in which students explore, evaluate, reflect, and apply word meanings in meaningful contexts" (p. 399).

Vocabulary Acquisition- Vocabulary acquisition is the process of learning new vocabulary words. Rupley and Nichols (2005) assert that "Children's acquisition of vocabulary is essential for gains in reading comprehension and reading development" (p. 239).

Vocabulary Retention- Vocabulary retention is the process of remembering or holding the knowledge of the vocabulary words previously learned.

Wiki- According to Meishar-Tal and Gorsky (2010), wikis are, "online environments that enable the co-creation of online documents" (p.26). Anyone can add or edit information on wikis at any time (Richardson, 2006). Richardson (2006) describes a wiki as an area that inspires the "collaborative construction of knowledge" (p. 61). Most wikis are free via open source and many can be password protected (Richardson, 2006). Schools have the option of utilizing password protected wikis to create online learning spaces (Richardson, 2006). Richardson (2006) describes an additional feature of wikis that schools and teachers find helpful, a page history. The page history tells who made which edits. If anyone vandalizes the wiki, it is relatively easy to see who posted what,

and one can revert back to a previous version. The site that was utilized in this study is pbworks.com, which offered password protected wikis for educators and students.

Word Wall- According to Harmon et al. (2009), a word wall has many uses and is extremely adaptable. Word walls are typically seen in elementary schools, but can be found in any classroom. The authors also found three main uses of the word wall in the classroom: The word wall (1) provides many exposures to vocabulary words, (2) aids students in acquiring word meanings, and (3) enables students to activate prior knowledge (Harmon et al., 2009).

Summary

Vocabulary is a significant aspect of learning, but unfortunately is an often neglected part of the school day (Berne & Blachowicz, 2008; Biemiller & Boote, 2006). Although vocabulary acquisition and retention is important solely on its own merits, there is another reason to spend time researching in this area. Many researchers have found that vocabulary knowledge is closely connected with reading comprehension (Anderson & Freebody, 1981; Anderson & Freebody, 1985; Beck, McKeown, & Kucan, 2002; Graves, 2004; NICHD, 2000; RAND Reading Study Group, 2002; Snow, Burns, & Griffin, 1998), and this provides an additional purpose in studying effective vocabulary instructional techniques.

Although researchers have found that the vocabulary gap continues to widen throughout students' school careers (Graves, 2009; Hart & Risley, 1995), there continues to be hope in this area. Teachers currently have numerous advancements in technology and additional mediating technological tools become available on a regular basis. Digital tools such as the Internet can be quite helpful in instructing students in

vocabulary (Dalton & Grisham, 2011). Additionally, allowing students to engage in collaboration (Allen, 1999; Arter & Nilsen, 2009; Wells, 2000) as well as providing opportunities for the students to express themselves creatively (Arter & Nilsen, 2009) can lead to significant vocabulary growth. This growth requires that teachers devote time to vocabulary instruction (Allen, 1999), and, while wide reading is important (Stahl & Nagy, 2006), teachers must also allow for time in the day to teach vocabulary words explicitly (Allen, 1999; Bryant, Goodwin, Bryant & Higgins, 2003).

CHAPTER 2: REVIEW OF THE LITERATURE

One purpose of this study was to determine the effect of a digital word wall on students' vocabulary acquisition and retention when compared to the use of a non-digital word wall. A second purpose was to determine what impact the digital component had on student and teacher engagement and motivation in the realm of vocabulary. In order to more fully understand this concept of vocabulary teaching and learning, it is necessary to begin with the foundation of American education. Therefore, this chapter opens with a historical perspective of vocabulary instruction. After understanding how vocabulary teaching and learning has evolved over the years, the study is then framed with a sociocultural lens. This lens should enable the reader to better understand the collaborative nature of both the digital and non-digital word walls.

Historical Perspective

To fully understand the workings of the earliest period of reading instruction in America (1607-1776), it is actually necessary to begin with the educational system in England (Smith, 1934). When the Church of England shifted from a Catholic grounding to a Protestant focus, the educational system in England changed as well. The shift to Protestantism resulted in a greater emphasis on reading due to the fact that under Protestantism, students must read the word of God in order to draw their own conclusions (Smith, 1934). These religious influences were indeed visible in the new American colonies. The reading and spelling books of this time period were based on

religious doctrine (Smith, 1934). Vocabulary, in this earliest period in American history, encompassed simple and complex words; the complexity of the words was based on the number of syllables and letters the words contained (Smith, 1934). There were lists of words which began with the simple words that contained one letter and/or sound. The vocabulary lists progressed with each list in possession of words with additional syllables. At that time, there was no provision for repetition of words in the readers in order to insure adequate practice and retention of word meaning for the students (Smith, 1934). Many new words occurred only once throughout the entire reader (Smith, 1934). In addition to the little amounts of repetition, Smith (1934) found that there was no attention paid to the introduction of new words. In fact, one could find from twenty to one hundred new words on a single page.

In the early 1900s, there was a scientific focus on reading instruction (Shannon, 2007). The Committee on the Economy of Time in Education was formed and published reports in four yearbooks for the National Society for the Study of Education (NSSE). These reports were published from 1915 through 1919 (Shannon, 2007). The authors became quite regulatory in tone as the years progressed, and vocabulary was viewed as an area that could be scientifically utilized in the teaching of reading. Teachers were told that they should analyze the words in a text to determine which ones were high frequency words. These words were the ones that were to be taught as vocabulary in order to increase the efficiency of instruction (Shannon, 2007). It was during this time period that the variability in vocabulary between the different publishers' reading textbooks led to a multitude of teachers and schools using one publisher's reading texts throughout the grades. Prior to this switch, a student who may

have been able to independently read in his or her text of one publisher may not have been able to read on the same level of a reader by a different publisher. As the focus at this time was silent independent reading, many felt it was best to move to one publisher's reading text in order for the students to develop familiarity with the words (Shannon, 2007).

In the last thirty years, vocabulary knowledge has been found to be strongly connected to comprehension (Anderson & Freebody, 1981; Anderson & Freebody, 1985; Beck, McKeown, & Kucan, 2002; Cunningham & Stanovich, 1997; Graves, 2004; NICHD, 2000; RAND Reading Study Group, 2002; Snow, Burns, & Griffin, 1998) as well as to reading proficiency and to school in general (Beck, McKeown, & Kucan, 2002). Unfortunately, many vocabulary programs currently consist of a skill and drill type model with the typical fill-in-the-blank, multiple-choice, dictionary search activities (Zutell, 2008). This type of vocabulary instruction has been proven to be ineffective (Nagy, 1988). Currently, researchers find that vocabulary knowledge can be augmented through contextual experiences (Nagy, 1988; Wells & Narkon, 2011) and that vocabulary instruction must accompany wide reading (Beck & McKeown, 2007; Taylor et al, 2009). Researchers know that vocabulary acquisition does not occur through context alone (Beck, McKeown, & Kucan, 2002; Nagy, 1988) and must include direct instruction (Blachowicz & Fisher, 2006). Researchers (Beck, McKeown, & Kucan, 2002) have found that many of the students who need vocabulary instruction the most do not read very often. When these students do read, they often struggle with decoding and understanding the words in the text (Beck, McKeown, & Kucan, 2002), resulting in a Matthew Effect where the good readers get better and the poor readers

continue to suffer (Beck, McKeown, & Kucan, 2002; Zutell, 2008). The literature demonstrates that vocabulary teaching and learning has changed significantly throughout our nation's history; however, we need more research as we still have much to learn to better vocabulary instruction (Biemiller & Boote, 2006).

Theoretical Base

The purpose of this study was to emphasize the need for alternative vocabulary instructional methods to enable students to more significantly increase their vocabularies. In this study, students worked collaboratively on digital word walls in order to broaden their vocabularies and increase their motivation to become logophiles, learners who collect and enjoy words and word learning for many years to come. Since this study used collaborative activities, specifically the use of wikis to learn vocabulary, this study is best viewed through a sociocultural lens.

Sociocultural lens. Knowledge and learning is created and then re-created as students bring their own personal experiences and understandings to a situation (Wells, 2000). Vygotsky (1986) posited that learning takes place through social interactions. Sociocultural theory can be described as one in which learning is considered to take place, not just individually, but within collaborative groups; it is important to examine learning in relation to how it is socially situated and the many forms of interaction that take place with other people (Bakhtin, 1981; Vygotsky, 1986; Wertsch, 2002). As students in this study were operating within the social situation of school, studying the students and their digitized word learning within a sociocultural framework led to a more in-depth understanding of the phenomena.

The founder of sociocultural theory, Vygotsky, framed his work around this central question: How do humans, considering where they start from, progress to such great depths of understanding and knowledge (Wells, 2000)? Vygotsky was concerned with human trajectories, their penchant to travel such great distances in different directions, and their ability to achieve great feats of knowledge (Wells, 2000). To answer these haunting questions, Vygotsky discovered the necessity of researching, not merely the individual, but the individual and his environment, including materials and other people (Wells, 2000).

There are three main features of Vygotsky's theory: (1) ontogenetic development should be studied with a focus on how it is historically, politically, and socially situated; (2) artifacts serve a mediating role on human activity; and (3) constructive relationships exist between individuals and the society to which they belong (Wells, 2000).

Due to the collaborative nature of learning and the fact that it should be viewed and studied not as an independently conducted activity, but as an important and constitutive community activity (Lave & Wenger, 1991; Vygotsky, 1978; Wells, 2000), this study incorporated the collaborative nature of learning by ensuring students worked in groups to foster discussion. Valuing the collaborative nature of learning afforded the students greater learning opportunities.

Vygotsky (1978; 1986) also proposed the concept of the zone of proximal development (ZPD), in which it is purported that students have both an actual and potential level of development. Vygotsky (1978) defined the ZPD as the distance between the student's level of actual development and the student's level of potential

development. What is termed the “actual development” level is what the student is able to do on his or her own without the help of someone else, whether that person is an adult or a peer (Vygotsky, 1978; 1986). The “potential development” level is what the student can do with assistance from a more advanced adult or peer (Vygotsky, 1978; 1986). Within the ZPD, the student and the teacher (or more able peer) work with one another to achieve new levels of learning. Working together with more able peers on the digital and non-digital word walls, the lower performing students in this study were most likely able to achieve greater heights of knowledge in the realm of vocabulary acquisition and retention.

Vocabulary Instruction

Vocabulary teaching and learning has clearly evolved. The evolution began with vocabulary instruction referring merely to the teacher’s ability to correctly elicit the proper pronunciation of multisyllabic words from her students (Smith, 1934) and progressed to the idea that vocabulary knowledge and reading comprehension are closely linked (Anderson & Freebody, 1981; Anderson & Freebody, 1985; Beck, McKeown, & Kucan, 2002; Cunningham & Stanovich, 1997; Graves, 2004; NICHD, 2000; RAND Reading Study Group, 2002; Snow, Burns, & Griffin, 1998). Researchers now know that some students do not have the comprehensive vocabularies that their peers have control of (Hart & Risley, 1995). With all this information, it is imperative that researchers continue to determine effective methods for vocabulary instruction.

Vocabulary development and learning is a slow process and one that lasts throughout life (Rupley & Nichols, 2005; Thompson, 1958). Some researchers (Nagy & Anderson, 1984; Nagy, Herman, & Anderson, 1985) posit that vocabulary growth is

mostly incidental and typically takes place during wide reading. Other researchers (Beck & McKeown, 2007; Rupley & Nichols, 2005; Taylor et al, 2009) believe that explicit instruction is oftentimes more powerful and have conducted studies in order to find the best ways to purposefully teach vocabulary in the classroom. Beck and McKeown (2007) studied the effect of decisively teaching vocabulary words to kindergarteners and first graders. There were two groups in the study: one group was explicitly taught the selected words, and the second group received no vocabulary instruction. Both groups were read trade books and exposed to the same read-alouds. Group one learned substantially more than the group that received no vocabulary instruction. Beck and McKeown (2007) then studied the effects of doubling vocabulary instruction. One group got three days of vocabulary instruction and the other group received six days of vocabulary instruction. The group that received additional instructional time learned twice as many vocabulary words.

Beck and McKeown (1991) reported several "truths" about vocabulary instruction. First of all, when dealing with vocabulary, any instruction at all is better than no instruction. Also, they found that there was not a particular vocabulary instructional method that was shown to be better than another. Beck and McKeown (1991) also found that vocabulary methods that used a variety of techniques were better than those that only used one technique. Repeated exposures have been found necessary for most vocabulary acquisition (Beck & McKeown, 1991; Dalton & Grisham, 2011; Nagy, 1988; Yates, Cuthrell, & Rose, 2011). Each time a student encounters a word, he or she internalizes a piece of the meaning; as the student continues to encounter the word, the knowledge of that word becomes richer and more accurate (Dalton &

Grisham, 2011; Graves, 2009). To truly learn the word and its meaning, students should have multiple exposures to vocabulary words, and they should be provided with many opportunities to encounter and manipulate the words in various situations (Beck & McKeown, 1991; Graves, 2009; Nagy, 1988; Stahl & Kapinus, 2001). These opportunities for students to come across vocabulary words can be a brief and natural part of the classroom; for example, students might encounter the words in a read-aloud or during a class conversation (Graves, 2009).

Echoing many of the same findings, Fisher (2007) worked on a vocabulary initiative with urban high school students from 2001 until 2005. Fisher worked with an at-risk school high school- one of the lowest performing in the state. A group of parents, teachers, and administrators collectively researched and created a five-part vocabulary plan. When the plan went into effect: (1) students had more built-in time to read during the day, (2) teachers read more often to students, (3) teachers developed content-specific vocabulary instruction, (4) students were taught academic words, and (5) students and staff focused on five words a week with a common prefix, suffix, or root (Fisher, 2007). Fisher (2007) found that it was important to have the whole school working together. When the five-part vocabulary plan was put into effect, there were significant gains in student achievement. First of all, the average reading student scored two years higher on a reading comprehension test. Second, there were great gains in vocabulary achievement. The greatest gain occurred in the eleventh grade sample. In 2001, eleventh graders answered 30% of vocabulary questions correctly while in 2005, eleventh graders answered 75% of vocabulary questions correctly. Fisher (2007) found that when the students, staff, and parents invested time, money, and attention, the

students experienced exponential growth in vocabulary and reading comprehension. Fisher (2007) maintained that there was no quick fix for vocabulary achievement.

The National Reading Panel (NICHD, 2000) declared, “While much is known about the importance of vocabulary to success in reading, there is little research on best methods” (p. 17). The purpose of this study was to contribute to the body of knowledge for best methods in the field of vocabulary instruction. In order to lay a foundation of current best practices, the following concepts will be examined: (1) word walls, (2) Frayer method of conceptual learning, (3) morphology, (4) Greek and Latin root study, (5) digital literacies, (6) vocabulary and technology, and (7) engagement and motivation.

Word walls. Word walls can be found in many classrooms. Most print-rich environments, integral to a classroom that values vocabulary learning and vocabulary awareness, tend to contain the common feature of a word wall (Cunningham, 2000). Word walls can be defined in many ways and can have a variety of purposes: word analysis, spelling, or vocabulary (Brabham & Villaume, 2001). Moreover, teachers can have multiple word walls that have different purposes in the classroom (Blachowicz & Fisher, 2006; Brabham & Villaume, 2001). For example, a particular teacher might have a word wall with commonly misspelled words as well as a word wall with Greek and Latin roots and their meanings. Harmon, Hendrick, Wood, Vintinner, and Willeford (2009) found three main uses of the word wall in the classroom; the word wall (1) provides many exposures to vocabulary words, (2) aids students in acquiring word meanings, and (3) enables students to activate prior knowledge. Although word walls have several purposes and varied uses, word they typically have several attributes in

common. Brabham and Villaume (2001) assert that most word walls: (1) contain sets of words that are cognitively appropriate for students, (2) are comprised of purposely selected words, (3) are cumulative, meaning the words should remain available and in sight for students even as other words are added, (4) are only one part of the instruction, in other words teachers should have activities and discussions around the words and should provide scaffolding to allow students to think about and use the words, and (5) support students in their independent reading and writing activities.

Word walls do not have to be expensive or overly time consuming. Blachowicz and Fisher (2006), when summarizing a study comprised of word walls, maintained that "very little expense, instructional time, or effort was involved" (p. 197). Yet, even with few resources, much learning took place. When word walls were involved, students often became excited about learning words (Blachowicz & Fisher, 2006; Jasmine & Schiesl, 2009; Yates, Cuthrell, & Rose, 2011) and rapidly took ownership of the word walls (Jasmine & Schiesl, 2009; Yates, Cuthrell, & Rose, 2011). Teachers must do more than put the words on the wall (Brabham & Villaume, 2001; Jasmine & Schiesl, 2009; Harmon, Wood, & Kiser, 2009; Yates, Cuthrell, & Rose, 2011). At the onset of their study with first graders, Jasmine and Schiesl (2009) noted that many students were unable to use the word wall to pronounce or locate a word. The researchers attributed this to a failure on the teacher's part to incorporate daily activities and reinforcements. In order for great learning to take place, word wall activities should give the students an opportunity to practice and use the words because it is not enough for a word wall to be merely present in the classroom (Brabham & Villaume, 2001; Jasmine & Schiesl, 2009; Harmon, Wood, & Kiser, 2009; Yates, Cuthrell, & Rose, 2011).

Harmon, Wood, and Kiser (2009) have termed the word wall that allows for active engagement the i*nteractive word wall*. They define the purposes of the interactive word wall as: (a) associating word features and meanings with familiar ideas, concepts and experiences; (b) engaging students actively in multiple, varied, and meaningful experiences with words; and (c) highlighting student choice. Yates, Cuthrell, and Rose (2011) go on to elaborate that "the interactive word wall concept emphasizes the difference in *having* a word wall and *doing* a word wall" (p. 84; emphasis in original).

A proponent of word walls, Green (2003) found that when he utilized an interactive word wall in his classroom that his students excelled. Green's word wall can be described as interactive because his students played games, designed lessons, and utilized the words daily (Green, 2003; Harmon, et al., 2009). He used word walls with all of his students, despite ability levels, in both urban and suburban schools. Word walls can certainly be used with all students: beginning readers and writers, developing readers and writers, and struggling readers and writers (Brabham & Villaume, 2001). Green (2003) found that when he utilized the word wall in his classroom, his students' scores on the California Test of Basic Skills were higher. Not only can scores increase, but many teachers report that with the use of a word wall, their students have an amplified desire to learn (Jasmine & Schiesl, 2009; Yates, Cuthrell, & Rose, 2011). The interactive word wall enables teachers to incorporate many, if not all, dimensions of literacy: reading, writing, speaking, listening, viewing, and visually representing, into the learning (Wood, Harmon, & Taylor, 2011).

The Frayer model. The Frayer model, or method, is an approach that was originally created to assess conceptual understanding and has been recently described as

one of the most complete methods of teaching new words (Blachowicz & Fisher, 2006). Frayer, Frederick, and Klausmeier (1969) focused on concept learning and cognitive skills in a laboratory setting at the University of Wisconsin. The researchers determined that several cognitive skills were necessary in order to foster conceptual understanding. They found that assessments of classroom learning should have the following components: "(a) test both nonverbal and verbal aspects of concept learning, (b) permit differentiation of various levels or aspects of concept mastery, and (c) be applicable to various types of concepts" (p. 3).

Frayer, Frederick, and Klausmeier (1969) suggest the following information be present when testing a concept: "(a) the names of the attributes which comprise the concept examples, and which are relevant and which are irrelevant to the concept, (b) examples and non-examples of the attribute values, (c) the name of the concept, (d) concept examples and non-examples, (e) a definition of the concept, (f) the names of the supraordinate, coordinate, and subordinate concepts, (g) principles entailing the concept, and (h) problems which may be solved by relating principles involving the concept" (p. 9). Although there are quite a few components to their approach, the researchers maintain that items may be omitted if they are not of use to the test constructor or not appropriate for the situation at hand (Frayer, Frederick, and Klausmeier, 1969).

More current research indicates that the Frayer Model is very useful not only as an assessment guide but also as a teaching tool (Blachowicz & Fisher, 2006; Graves, 2009; Whitaker, 2008). Researchers find that it is best to use either a four-step (Whitaker, 2008) or six-step (Graves, 2009) Frayer Model format. Whitaker (2008)

advocates for the four- step approach to the Frayer Model; she posits that it is best to have the following components: (1) definition of the word, (2) characteristics of the word, (3) examples of the word, and (4) non-examples of the word. In addition to merely listing examples and non-examples of the concept, Blachowicz and Fisher (2006) suggest teachers have students explain their choices. Graves (2009) describes the six steps that he finds useful. Step one requires that the student define the new concept, and illustrations are helpful here. The second step entails students discerning between the new concept and other similar concepts. Third, students have to give examples of the concept. The fourth step requires that students give non-examples of the concept. In step five of the procedure, students are given both examples and non-examples and must discriminate between the two. The sixth step involves students presenting their findings.

While the Frayer model is useful as a testing implement (Frayer, Frederick, & Klausmeier, 1969) as well as a teaching tool (Blachowicz & Fisher, 2006; Graves, 2009; Whitaker, 2008), it will be utilized as a teaching tool for the purpose of this study. It was chosen as a teaching tool for this study as it encompassed several meaningful facets of vocabulary instruction. In the present study, students were required to provide the following information regarding their Greek or Latin root that they were working with: (1) an example of a word that contained the Greek or Latin root, (2) a picture or illustration to represent the word, and (3) a sentence that provided context for the word. These requirements all contributed to a deeper understanding of the Greek and Latin roots. Furthermore, the modified Frayer model (see Appendix D) utilized in this study was easily replicated both on paper and digitally. For the sake of the study, it was

important that students were responsible for the same requirements whether they were working on the digital or non-digital word wall.

Morphology. Morphological awareness is a vital part of word learning in the classroom (Baumann, Edwards, Font, Tereshinski, Kame'enui, & Olejnik, 2002; Nagy, Berninger, & Abott, 2006; Rasinski, Padak, Newton, & Newton, 2011) and entails a student's ability to reflect upon and manipulate morphological units (Baumann et al., 2002; Nagy, Berninger, Abbott, Vaughan, and Vermeulen; 2003). Nagy, Berninger, and Abbott (2006) found that in the fourth through ninth grades, morphological awareness contributes to the following aspects of reading and writing: (1) vocabulary, (2) spelling, (3) decoding accuracy, and (4) decoding rate. Moreover, some researchers (Nagy, Berninger, & Abbott, 2006) have hypothesized that morphological awareness actually makes an independent contribution to reading ability.

Nagy, Berninger, Abbott, Vaughan, and Vermeulen (2003) feel strongly that morphological awareness and literacy as well as morphological awareness and vocabulary are connected in what are most likely reciprocal relationships. In fact, declaring the utmost importance of teaching morphological awareness, Nagy et al. (2003) wrote, "meaning signaled by internal word parts may also be the key to unlocking higher order meaning in the mature written texts children should eventually learn to read and write by the high school years—the ultimate goalpost of high-stakes literacy standards" (p. 741). In their study of fifth graders, Baumann et al. (2002) found that for every morphological word part a fifth grader learned, he or she was able to comprehend one to three additional words based on the child's ability to use context and morphology. Nagy, Berninger, and Abbott (2006) established that the breaking of

morphologically complex words into their composite morphemes typically enabled students to more easily and fluently recognize complex words for the following reasons: (1) the frequency of morpheme parts is higher than the frequency of a morphologically complex word, and (2) morphologically chunking the word typically results in fewer units of meaning that need to be processed.

A teacher in the Mountain study (2005) noted, “Morphemic analysis may be only one of many ways to narrow the gap between the vocabulary ‘haves’ and the ‘have nots’” (p. 744). This teacher then went on to describe how she realized that many experts as well as other teachers have recommended this strategy. She was quite eager to begin learning how to best teach her students morphemic analysis strategies. Many researchers agree on the importance of morphemic analysis in the classroom (Dalton & Grisham, 2011; Edwards, Font, Baumann & Boland, 2004; Nagy, Berninger, & Abott, 2006; Nagy, Diakidoy, & Anderson, 1993; Rasinski et al., 2011). Edwards, Font, Baumann, and Boland (2004) assert that “students skilled in morphemic and contextual analysis have the potential to increase their vocabulary breadth and depth substantially” (p. 161).

While many researchers agree on the importance of morphological study in the classroom (Dalton & Grisham, 2011; Edwards, Font, Baumann & Boland, 2004; Nagy, Berninger, & Abott, 2006; Nagy, Diakidoy, & Anderson, 1993; Rasinski et al., 2011), several researchers disagree on the number of roots/affixes to study per week. Graves (2009) suggests two to four while Rasinski et al. (2011) suggests one to two. Meeting in the middle of Graves’ (2009) and Rasinski’s (2011) suggestions, this study allowed students to focus on three root words per week. Morphological instruction leads to

morphemic analysis, which is determining the meaning of a word by analyzing its parts such as the root words, prefixes, suffixes, and inflected endings (Edwards, Font, Baumann, Boland, 2004). Morphemic analysis has been found to be appropriate for students in grades four and higher (Nagy, Diakidoy, & Anderson, 1993; White, Power, & White, 1989). To study words through the use of morphemic analysis, students have to break the word into its parts, determine the meaning of the word's parts, and must finally reconstruct the multiple meanings of the word parts in order to understand the meaning of the more complex word (Edwards, Font, Baumann, & Boland, 2004).

Part of morphology is the study of Greek and Latin root words. Greek and Latin root words were chosen because of the curriculum standard requirements of the southeastern state in which the study took place. This state required that all fifth grade students know a list of 26 Greek and Latin root words and affixes by the culmination of their fifth grade year. This study focused on 18 of the prefixes and root words which were contained in that list (See Appendix C). The following section provides additional information about the significance of Greek and Latin roots. Specifically, why it is an important and necessary dimension of word study and vocabulary knowledge.

Greek and Latin root words. English has more words than any other language (Zutell, 2008). This plethora of words and meanings is one reason that it is important for students and teachers to focus on word parts. The study of word parts is essential as researchers estimate that words with multiple morphemic elements outnumber single morpheme words with a ratio of four to one (Wysocki & Jenkins, 1987). As students progress through the intermediate grades and on through secondary school, the sheer number of content area words which are constructed of roots and affixes increases

significantly (Alvermann & Phelps, 2002). A root is defined as “the basic part of a word that usually carries the main component of meaning and that cannot be further analyzed without loss of identity” (Harris & Hodges, 1995, p.222).

Researchers have declared the effectiveness of teaching Greek and Latin root words in the classroom (Ebbers & Denton, 2008; Mountain, 2005; Rasinski et al., 2011). Due to the immense curriculum which must be covered, teachers are constantly on the lookout for instructional methods that allow students the biggest gains for the least costs (Alvermann & Phelps, 2002). Rasinski et al. (2011) posited that teaching Greek and Latin root words is a brilliant instructional strategy if the teacher’s intention is to provide vocabulary instruction in the most efficient manner possible. This efficiency is due, in large part, to the fact that knowing a single root can open the door to the meanings of numerous other words (Alvermann & Phelps, 2002; Ebbers & Denton, 2008; Holmes & Keffer, 1995; Mountain, 2005; Rasinski et al., 2011).

Researchers have found a multitude of reasons to study Greek and Latin roots (Blachowicz & Fisher, 2006; Rasinski et al., 2011). First, most academic words hail from Greek and Latin root words (Alvermann & Phelps, 2002; Rasinski et al. 2011). Second, many difficult multisyllabic words come from Greek and Latin roots (Rasinski et al. 2011). Third, studying one Greek or Latin root can help aid in the comprehension of numerous English words (Ebbers & Denton, 2008, Rasinski et al. 2011). In fact, Rasinski et al. (2011) specifically estimates that studying one Greek and Latin root can actually aid in the comprehension of twenty English words. Words can be clustered into root families without much difficulty (Ebbers & Denton, 2008). For example, Ebbers and Denton (2008) wrote that “the Greek combining form (or root) *chron* denotes the

concept “time” as seen in the morphological family *chronological*, *synchronize*, *chronic*, *anachronism*, and *chronometer*” (p. 95; emphases in original). Grouping the previous words into the root family for study can promote student comprehension (Ebbers & Denton, 2008). Fourth, due to the prevalence of Latin roots in the Spanish language, the study of Greek and Latin roots can help Spanish-speaking students use their native language to better understand English (Blachowicz & Fisher, 2006; Rasinski et al., 2011). Blachowicz and Fisher (2006) suggest teachers of bilingual students begin with the root words which are common to both Spanish and English speakers. They then suggest that after the students are familiar with the common roots, teachers can have the students progress to others (Blachowicz & Fisher, 2006).

As Harmon et al. (2009) found, word walls can be an incredible tool to utilize with a Greek and Latin root word and prefix study. The students in this study focused on Greek and Latin roots with the instructional methods of both a digital and non-digital word wall.

Prefixes. A prefix is an affix, or bound morpheme (Edwards, Font, Baumann, & Boland, 2004). Teaching prefixes is an excellent use of classroom time as teaching certain prefixes will allow students to infer the meanings of a myriad of newly encountered words. In fact, fifteen of the most frequently occurring prefixes occur in four thousand words (Graves, 2004). White, Sowell, and Yanagihara (1989) found that twenty of the most frequent prefixes, if explicitly taught, can enable students to decipher the meanings of nearly 3,000 prefixed words.

Of the seven prefixes that fifth grade students in a Southeastern state are responsible for learning, five appear on White, Sowell, & Yanagihara’s list: en-/em- is

number five on the list and is found as a prefix in 132 words, mis- is number nine on the list and is found in 83 words, inter- is number twelve on the list and is found in 77 words, semi- is number 17 on the list and is found in 39 words (White, Sowell, & Yanagihara, 1989). In effect, by teaching these five prefixes, teachers are giving student access to unlocking the meanings of at least 331 words.

Stauffer (1942) found that nearly twenty-five percent of the 20,000 words in Thorndike's (1932) word list were prefixed words. This is a significant amount of words. Therefore, it is important to teach prefixes as it will give students access to a larger vocabulary. An additional reason to begin instruction with prefixes is that they are found, as the name signifies, at the beginning of words. This can be an advantage for students as they can more easily discern a prefixed word. The meanings of prefixes are typically simple (Graves, 2004). For example, "pre" means before and therefore, pregame is something that takes place before the game begins (Graves, 2004). For the aforementioned reasons, prefixes are an excellent area in vocabulary to begin instruction (Graves, 2004; White, Sowell, & Yanagihara, 1989).

However, prefix instruction can result in some misconceptions in the students' minds. Teachers should address the following challenges with their students prior to and during instruction: (1) some words begin with prefix letters but are not prefixed words (for example, regal has nothing to do with the prefix re-), (2) some prefixes have multiple meanings, and (3) some meanings have several prefixes (Graves, 2004).

Vocabulary and technology. Computers have been in a majority of classrooms for the last three decades (Cisco Systems, 2006). Schools have cited several reasons for utilizing computers and other technology in the classroom: (1) to augment learning, (2)

to increase student engagement, and (3) to build 21st century skills (Cisco Systems, 2006).

There have been numerous studies conducted to examine the effects of using technology in order to teach vocabulary. Specifically, studies have been conducted to examine the effects of technology (1) with students learning an additional language (Chen, Quadir, & Teng, 2011; Liu, Moore, Graham, & Lee, 2000), (2) with students who had learning disabilities (Narkon, Wells, & Segal, 2011), and (3) with English Language Learners (Fraga, Harmon, Wood, & Buckelew-Martin, 2011; Patten & Craig, 2007). After conducting a review of the literature, Liu, Moore, Graham, & Lee (2000) found that there are indeed positive learning outcomes for users of technology in the area of vocabulary acquisition.

There are several examples of positive learning outcomes when technology is used to augment vocabulary instruction for students (Narkon, Wells, & Segal, 2011; Patten & Craig, 2007). Narkon, Wells, and Segal (2011) studied the effects of an e-word wall on students with learning disabilities. They found that the auditory component as well as the individualized attention was beneficial in the learning of the students with learning disabilities (Narkon, Wells, & Segal, 2011). Patten and Craig (2007) studied the effects of students using an iPod on students' skills in reading, writing, and listening. The researchers found that vocabulary and writing skills increased when iPods were used as instructional tools with students who were English Language Learners (Patten & Craig, 2007).

This study utilized technology in a number of ways in order to provide students with vocabulary instruction. Students used a wiki to work on a digital word wall, and

they had access to digital dictionaries as well. A wiki was used to host the digital word wall in this study. The word wiki comes from the Hawaiian phrase, “wiki-wiki” which means “quick” (Richardson, 2006). A wiki is a website in which people can edit and add to the posted material at any time. The first wiki was created by Ward Cunningham in 1995 as a way to inspire people to publish written work. Richardson (2006) writes that wikis are quite simple to use and provide an area for the “collaborative construction of knowledge” (p. 61). In fact, Pegrum (2009), describes wikis as “social constructivism in motion: collaboratively constructed, constantly added to and modified, and always provisional” (p. 33). Blachowicz and Fisher (2006) found that positives of digital dictionaries include: (1) they are easy to use, (2) they pronounce the words for the students, and (3) they may be more convenient than their traditional, paper counterparts.

Blachowicz, Beyersdorfer, and Fisher (2006) believe that technology allows for a myriad of learning opportunities in the realm of vocabulary that are just beginning to be investigated. Although research is relatively new where vocabulary and technology are concerned, Blachowicz and Fisher (2006) postulate that technology is an area that “appears to have significant potential for vocabulary development” (p. 13). The aim of this study was to contribute to the body of knowledge in the area of vocabulary and technology with the hopes of improving vocabulary instruction for students through the utilization of technology.

Digital Literacy

As the world becomes “flat” and increasingly more aspects of our lives become digitized (Friedman, 2007), it is of utmost importance that classroom teachers increase digital literacies, or multiliteracies, in the classroom (International Reading Association,

2009). Digital literacies are continuously changing (Coiro, Knobel, Lankshear, & Leu, 2008) and are defined as, “social situated practices supported by skills, strategies, and stances that enable the representation and understanding of ideas using a range of modalities enabled by digital tools” (O’Brien & Scharber, 2008). There is an increasing portability and digitization of education; learning and school are no longer synonymous as learning can currently take place anywhere (Collins & Halverson, 2009). As this study sought to increase access and portability to students’ vocabulary learning, it was vital to look at this technological phenomenon closely. The digital word wall was one in which students were able to collaborate with their teacher and one another. It could be accessed from any computer. For example, it was possible for a student to be at home reading a novel when a word became significant. At that point, he or she could have added it to the digital word wall. The student did not need to be in school in order to augment the digital word wall.

The New London group, named for the small town in Connecticut in which they met, coined the term *multiliteracies* in the late nineties. The front runners in digital literacies, this group met with the intention of making literacy more accessible and useful for all students. The term multiliteracies encapsulates more than simply using the phrase “digital literacies.” Multiliteracies was the chosen word for the two main arguments that the New London group had with the new developing “cultural, institutional, and global order” (Cope & Kalantzis, 2000). The first argument dealt with increasing methods to communicate as well as increasing integration of the many different modes of meaning making such as the manner in which textual meaning is related to the visual, audio, and behavioral meaning (Cope & Kalantzis, 2000). The

second argument focused on the increasing diversity in the local realm and the increasing connectedness in the global realm. Students should be taught to cross linguistic boundaries on a daily basis (Cope & Kalantzis, 2000).

The New London group focused on the four components of pedagogy. The first component is situated practice and draws on the experience of meaning making in the students' life worlds (New London Group, 1996). In situated practice, students are immersed within a community of other learners and they engage in authentic practice of a specific task. Assessments should be used in a formative sense so that teachers are able to utilize the information to provide more helpful instructional tasks (New London Group, 1996). In the second component of pedagogy, overt instruction, students develop an explicit metalanguage of design. Teachers and other experts in the field provide students with learning activities, in a scaffolded sense, as well as explicit information. Students should gain a conscious awareness and control over the learning task at hand (New London Group, 1996). The third component of pedagogy, critical framing, is where the students are able to interpret social context and the purpose of designs of meaning. Students frame the practice that they have had and the information that they have gained in relation to the cultural, social, and historical systems of knowledge. Information must be made strange once more so that students are able to take a critical stance (New London Group, 1996). Finally, the fourth component is transformed practice. In transformed practice, students, as the meaning makers, become the designers of their social futures. Students will apply information that they have gained as well as revise and reconstruct knowledge that has been gained (New London Group, 1996).

Digital literacy is becoming increasingly important as technology becomes more prolific in the classroom and in the student's home life (International Reading Association, 2009; Luke, 2000; Williams, 2008). Teachers should be incorporating technology into the classroom in a variety of ways in order to better prepare students for the world (Cisco Systems, 2006; International Reading Association, 2009). Currently, schools seem to align themselves more closely with traditional print-based literacies (O'Brien & Scharber, 2008). This is an unacceptable practice as students consistently engage in digital literacies at the culmination of the school day. It would be a more effective practice to integrate new digital literacies in the classroom (O'Brien & Scharber, 2008). Constantly morphing and evolving, technology should be utilized, and students should be allowed the opportunity to interact with and maintain a dynamic and ever-changing relationship with technology.

There is a large gap between the digital literacies that students engage in and the working and practice of curriculum standards (Lankshear & Knobel, 2006). Therefore, a shift in pedagogical thinking is necessary in order to combine new and traditional literacies effectively (Lankshear & Knobel, 2006; O'Brien & Scharber, 2008). This study integrated vocabulary instruction and a digitized word wall. This should have encouraged collaboration and provided constant access to the wall for the manipulation of words and meanings.

Technology skills, as well as the aligned teamwork skills, become increasingly important when the students' future workplace is considered (New London Group, 1996). Jobs and the workplace are changing from concrete and hands-on to inferential and abstract (Collins & Halverson, 2009). Students must be prepared to successfully

enter this environment. Collaboration within the corporation as well as with others is paramount (Collins & Halverson, 2009; New London Group, 1996).

It has been established that literacy has ceased to be simply a set of stand-alone, traditional skills (Williams, 2008). In fact, literacy now entails social practices which are influenced by both context as well as culture (Williams, 2008). One of the most significant purposes of education is to provide students with the ability and the resources to gain social mobility (Cope & Kalantzis, 2000). As the world changes, jobs morph from being concrete and top-down to those in which collaboration and innovation are key. Educators must provide students with access to digital literacies and collaborative opportunities (International Reading Association, 2009).

The digital word wall, the focus of the present study, allowed students to take learning out of school and into their daily lives by ensuring that students had access to the wall when they were on their laptops or iPads at home. Students had access to increasing digital literacies and were able to work collaboratively on the digital word wall. It was the hopes of this researcher that this portability might inspire greater vocabulary acquisition as well as improved collaboration skills which could then transfer into the students' future workplaces.

Engagement and Motivation

Most students now have access to a plethora of technology (International Reading Association, 2009) which often holds their interest (Patten & Craig, 2007). Teachers are able to capitalize on this interest by utilizing digital tools for teaching and learning in the 21st century (Dreon, Kerper, & Landis, 2011; Richardson, 2006). Student engagement and motivation tend to increase with the utilization of digital tools such as

iPods (Fraga, Harmon, Wood, & Buckelew-Martin, 2011; Kukulska-Hulme, & Pettit, 2009; Patten & Craig, 2007). Furthermore, Fraga, Harmon, Wood, and Buckelew-Martin (2011) found that student engagement and motivation increase when podcasting is incorporated into the curriculum. In fact, student engagement and motivation have been found to increase with digital storytelling (Dreon, Kerper, & Landis, 2011), e-word walls (Narkon, Wells, & Segal, 2011), and websites in general (Lisenbee, 2009; Scanlon, Buckingham, & Burn, 2005).

Chen, Quadir, and Teng (2011) studied the effects of an integrated learning system on students' ability to learn an additional language. The integrated learning system consisted of books, a computer program, and a robot. The researchers found that the addition of that integrated learning system to the curriculum increased motivation and engagement for students to learn an additional language which the researchers attributed to the students' ability to interact with the technology (Chen, Quadir, & Teng, 2011). The study was not without negatives, however. The drawbacks were the need to continuously update the computer program and the high cost of implementing the program (Chen, Quadir, and Teng, 2011). Even with the negative aspects of technology and literacy, it remains the responsibility of researchers and literacy teachers to incorporate digital learning into the curriculum (International Reading Association, 2009). In order for students to become completely literate in today's world, they must become proficient in the new literacies of 21st century technologies. (International Reading Association, 2009).

It is rarely difficult to engage students where technology is concerned. (Alvermann, 2008). Online literacies are so motivating that students are typically very

excited, willing, and motivated to spend significant amounts of time creating and sharing content online (Alvermann, 2008). There are caveats for teachers, however. While technology can make learning fun in the eyes of students, it is most crucial that the learning take place in a meaningful context (Scanlon, Buckingham, & Burn, 2005).

Summary

This study had dual purposes. The first purpose was to determine the effect of a digital word wall on students' vocabulary acquisition and retention when compared to the use of a non-digital word wall. The second purpose was to determine the impact of the digital component on student and teacher engagement and motivation in the realm of vocabulary instruction. This chapter began with a look at the historical perspective of vocabulary instruction. Perhaps most significant, historically speaking, is that our perception of vocabulary instruction has changed from centering on lists of multisyllabic words to focusing on meaning and comprehension (Beck, McKeown, & Kucan, 2002; Smith, 1934).

A sociocultural lens framed this study. Sociocultural theory is a theory in which learning is considered to be socially situated and thought to best occur within collective groups (Vygotsky, 1986; Wertsch, 2002). As school is socially situated (Vygotsky, 1986), it was important to view the learning from the sociocultural perspective. Collaboration is essential for student learning. Therefore, it is paramount for students to have multiple opportunities to collaborate within the classroom (International Reading Association, 2009).

Vocabulary growth is thought to take place during wide reading (Nagy & Anderson, 1984; Nagy, Herman, & Anderson, 1985) as well as during explicit

instruction (Beck & McKeown, 2007; Rupley & Nichols, 2005; Taylor et al., 2009). Multiple exposures of words and meanings are vitally important for vocabulary acquisition (Beck & McKeown, 1991; Blachowicz & Fisher, 2006). One instructional method which allows for multiple exposures is the word wall (Harmon et al., 2009). An additional component of word learning in the classroom is morphological awareness (Baumann, Edwards, Font, Tereshinski, Kame'enui, & Olejnik, 2002; Nagy, Berninger, & Abott, 2006; Rasinski, Padak, Newton, & Netwon, 2011). This entails a student being able to reflect upon and manipulate morphological units (Baumann et al., 2002; Nagy, Berninger, Abbott, Vaughan, and Vermeulen; 2003). A part of morphological awareness is the study of Greek and Latin roots. This study of Greek and Latin roots has been found to be an efficient way to provide students with vocabulary instruction (Rasinski et al., 2011).

The present study involved two word walls: a digital and a non-digital. The format that students used to study and present their Greek and Latin roots was the Frayer model. The Frayer model is an approach which was originally developed to test students on their understanding of concepts (Frayer, Frederick, & Klausmeier, 1969). However, the Frayer model was used in this study as a teaching tool to encourage understanding (Graves, 2009; Whitaker, 2008). While both the digital and the non-digital word walls utilized the Frayer model concept, the digital word wall was the only wall which saw the use of technology incorporated with vocabulary instruction. Researchers have found that there can be positive learning outcomes when technology is used to augment vocabulary instruction for students (Narkon, Wells, & Segal, 2011;

Patten & Craig, 2007). This study sought to add to the body of knowledge on vocabulary learning through the utilization of technology.

CHAPTER 3: METHODOLOGY

Clearly, there is a global issue with struggling readers (Chall & Jacobs, 1983) and there is an established connection between vocabulary knowledge and reading comprehension (Anderson & Freebody, 1981; Anderson & Freebody, 1985; Beck, McKeown, & Kucan, 2002; Graves, 2004; NICHD, 2000; RAND Reading Study Group, 2002; Snow, Burns, & Griffin, 1998). In an effort to add to the body of research and in the hopes of arming struggling readers with an additional learning tool, this study aimed to determine if digitizing a word wall had a positive effect on vocabulary acquisition, retention, and motivation.

The study took place at Green Brook Elementary School (a pseudonym) and included two of the four fifth-grade teachers and their respective students. Green Brook, a public school located in a suburban area outside of a large southeastern city in the United States, serves prekindergarten through fifth grade students. The vocabulary instructional method that was in place with regard to acquisition of Greek and Latin roots was not meeting students' needs. On Monday, students were assigned one root for the week. They were then given the following information to write on their reading logs: (1) the weekly root, (2) the meaning of that root, (3) the weekly example of a word containing that root, and (4) the meaning of that word. For example, if the root was *micro*, the students would be told to write: *micro*- small as well as *microorganism*- a

very small organism. This information was written on their reading logs. On Tuesday through Thursday evenings, the students were responsible for finding an additional example of a word (and the meaning of that word) containing the Greek or Latin root under study. Students would also put their found words on the Greek and Latin root chart that could be found hanging on a wall in the classroom.

While the content of the digital and non-digital word walls consisted of Greek and Latin root words, the focus of this study was on the impact of the digitization of the word wall on vocabulary acquisition, retention, and motivation. The study was divided into four phases (See Table 1) and involved two teachers and their 43 students. The teacher of Class A, Ms. Lillian (all names are pseudonyms), had 22 students. The teacher of Class B, Ms. Narris, had 21 students. In phase one of the study, the researcher trained the two participating teachers on both the non-digital and digital word walls to ensure consistency of instruction between methods and classrooms. In phases two and three of the study, the students studied three Greek and Latin roots per week for six weeks. Not only did students study the 18 Greek and Latin roots, they also were exposed to and studied the words which contain those 18 Greek and Latin roots. During the introduction to the lesson (teachers spent more time with this on Monday, but reviewed it quickly Tuesday through Thursday), the teachers showed the interactive white board flipchart. The interactive white board flipchart (created with computer software) was similar to a Microsoft PowerPoint presentation and contained the three Greek and Latin root modified Frayer models for the week (see Appendix D). While showing the flipchart, the teacher discussed each root and its meaning. The teacher also provided the students with: (1) the example of the word that contained the Greek or

Latin root, (2) the word's meaning, (3) the sentence that used that word, and (4) the picture that illustrated the sentence. The flipchart was created by the researcher and was used in both classrooms. In summation, the students saw the same examples regardless of which classroom they were in.

Table 1: Phases of the Study

Phase	Dates	Details
Phase 1	January 10, 2012 to January 13, 2012	I met with and spoke to the teachers. I described the study, the purpose, and what we hoped to contribute to the field. Training began at this time. I trained one teacher on the digital word wall and one on the non-digital word wall. Consent forms were given to the teachers. Assent and consent forms were given to the students.
Phase 2	January 16, 2012 to February 3, 2012	Students learned three Greek and Latin roots per week. Both groups, the digital word wall group and the non-digital word wall group, learned the same three roots. The following protocol was utilized: **The teacher for the digital word wall:** ___ Used the flipchart (similar to a PowerPoint, but displayed on the interactive white board), that the researcher created, to introduce the three Greek and Latin roots for the week. ___ Provided students (who had been placed in collaborative groups of 4-6) with laptop or desktop computers. ___ Allowed time for students to find words containing the Greek and Latin roots (approximately 10-20 minutes) and create digital modified Frayer models (one for each root). Students saved these digital modified Frayer models to the digital word wall (the wiki). ___ Pulled up the students' digital Frayer models

Table 1: Continued

		on the interactive white board and allowed students time to present each digital modified Frayer model. ___ Had the students present the digital modified Frayer model in the following manner, "Our root is_____. The meaning of our root is _____. Our example is _____. Our sentence is _____. Our illustration is _____." For example, "Our root is co. The meaning of our root is together. Our example is cooperate. Our sentence is: the two friends cooperated on a big project in school. Our illustration is of two friends girls leaning over a table and working on a project." ___ Wrapped up the lesson by going over the meaning of each root once more. **The teacher for the non-digital word wall:** ___ Used the flipchart (similar to a PowerPoint, but displayed on the interactive white board), that the researcher created, to introduce the three Greek and Latin roots for the week. ___ Posted the provided 3x5 index cards with the root and meaning for all three roots. ___ Provided students (in collaborative groups of 4-6) with dictionaries. ___ Allowed time for students to find words containing the Greek and Latin roots (approximately 10-20 minutes) and create modified Frayer models (one for each root). ___ Allowed the students time to present each modified Frayer model.

Table 1: Continued

	February 3, 2012	___ Had the students present the modified Frayer model in the following manner, "Our root is_____. The meaning of our root is _____. Our example is _____. Our sentence is _____. Our illustration is _____." For example, "Our root is co. The meaning of our root is together. Our example is cooperate. Our sentence is: the two friends cooperated on a big project in school. Our illustration is of two friends girls leaning over a table and working on a project." ___ Wrapped up the lesson by going over the meaning of each root once more. ___ Posted the modified Frayer models in a visible place in the classroom for students to see. (Frayer models were posted close to the 3x5 index cards which had the root and meaning of the root.) In effect, all *co* modified Frayer models should be clustered around the *co* 3x5 index card which was labeled: *co- together*. Students took both the multiple-choice and vocabulary knowledge scale assessments for the nine Greek and Latin roots they had been studying for the past three weeks. The researcher met with both teachers after school and trained them on the other instructional method. Class A's teacher was trained on the non-digital method and Class B's teacher was trained on the digital method.
Phase 3	February 6, 2012 to February 24, 2012	Teachers and students switched instructional methods. Students in Class A learned with the non-digital word wall and students in Class B learned with the digital word wall. The protocol outlined in phase two was utilized in

Table 1: Continued

	February 24, 2012	phase three as well. Students took both the multiple-choice and vocabulary knowledge scale assessments for the nine Greek and Latin roots they had been studying for the past three weeks.
Phase 4	February 27, 2012 to March 9, 2012 **March 9, 2012**	The researcher conducted student and teacher interviews during this time period. Students took a culminating test which contained all six weeks of roots. (There were 18 roots total; 36 questions were on the multiple-choice assessment and 18 questions were on the Vocabulary Knowledge Scale Assessment) to measure for retention of words.

After the introduction, students (in groups of four to five) were given 20 minutes to work. In the digital word wall group, students were taken to the computer lab and given 20 minutes to create their digital Frayer models (they worked on one model for each of the Greek and Latin roots for a total of three Frayer models per day). Students used online dictionaries to find the meanings of words and Google Images to find pictures. Students were responsible for having the root, the meaning of the root, an example of a word with the root embedded, a definition of that word, a sentence, and an illustration. The teacher then projected the digital word wall on the interactive white board and groups presented their models using the following format, "Our root is_____. The meaning of our root is _____. Our example is _____. Our sentence is _____. Our illustration is _____." For example, "Our root is *co*. The meaning of our root is together. Our example is *cooperate*. Our sentence is: the two friends cooperated on a big project in school. Our illustration is of two friends girls leaning over a table and working on a project." This took place Monday through Friday.

The non-digital word wall group had similar responsibilities. After the introduction, students (again in groups of four to five) were handed three empty Frayer models (on white copy paper) to complete. Students had to use a dictionary to locate words that contained Greek and Latin roots and the meanings of those words. Students were responsible for finding the root, the meaning of the root, a word containing the Greek or Latin root, the meaning of that word, a sentence and an illustration. Again, the students presented their work to the rest of the class using the following format "Our root is_____. The meaning of our root is _____. Our example is _____. Our sentence is _____. Our illustration is _____." For example, "Our root is *co*. The meaning of our root is together. Our example is *cooperate.* Our sentence is: the two friends cooperated on a big project in school. Our illustration is of two friends girls leaning over a table and working on a project."

During the first three weeks of the study, each of these groups covered the first nine Greek and Latin roots. At the three week mark, the teachers switched instructional methods. The group that had been using the digital word wall for the last three weeks (Class A) was instructed with the non-digital word wall. The group that had been using the non-digital word wall (Class B) then used the digital word wall. For weeks four through six of the study, each of the groups covered the second set of nine Greek and Latin roots. The questions that the researcher sought to answer through this study were as follows: (1)What effect does the use of a digital word wall have on students' vocabulary acquisition when compared to the use of a non-digital word wall? (2) To what extent do students retain knowledge of the vocabulary words when using the

digital word wall when compared to the non-digital word wall? and (3) What are teachers' and students' perceptions of the digital word wall? Specifically, to what degree is the digital word wall considered an engaging, motivating tool for acquiring and retaining vocabulary?

The researcher was interested in determining the effect of the digital word wall on vocabulary acquisition and retention in addition to the effect of that digital word wall on student engagement and motivation. Therefore, a mixed methods approach to the study was most appropriate. The study was designed as a mixed-methods study and as such was approached from a pragmatic paradigm. Pragmatism, popular for mixed methods research, has been found to be the best worldview for a mixed methods study (Creswell & Plano Clark, 2011; Tashakkori & Teddlie, 2003). The study was problem-centered, pluralistic, and positioned toward what works in real-life (Creswell & Plano Clark, 2011). Creswell and Plano Clark (2011) have argued that aligning with a pragmatic paradigm allows the researcher to abandon the "forced choice dichotomy between post positivism and constructivism" (p. 44). A modified vocabulary knowledge scale (Dale, 1965; Stahl & Bravo, 2010; Wesche & Paribakht, 1996) and a multiple-choice vocabulary assessment (Graves, 2009) were administered at several points throughout the study. Interviews were administered at the culmination of the study. Scores for the vocabulary knowledge scale and the multiple-choice vocabulary assessment were analyzed utilizing SPSS through a two-way repeated measures ANOVA. These assessments aided in determining the degree to which vocabulary acquisition and retention had occurred. The interviews were analyzed and coded, and

were useful in determining the degree to which the different modes of vocabulary instruction were motivating and engaging.

Research Methodology

Mixed methods design. The mixed-methodology is a relatively recent research approach and is used predominantly in the social and human sciences. A mixed-methods approach combines aspects from both quantitative and qualitative research methodologies. This approach has been gaining in popularity as using a quantitative or qualitative approach is often inadequate to address the complex problems often found in the social and human sciences (Creswell, 2009). In order to address the research questions, this study specifically employed an explanatory mixed-methods approach, also termed an explanatory sequential design mixed methods approach (Creswell & Plano Clark, 2011). The explanatory design has two phases. Each phase is distinctive as well as interactive (Creswell & Plano Clark, 2011).

In this study, the initial phase of the data collection consisted of quantitative data as the quantitative data had priority for answering the questions in this study. In fact, two of the three questions were answered with quantitative data. The second phase of data collection involved the qualitative piece and followed the results of the quantitative phase (Creswell & Plano Clark, 2011). The researcher used the interviews that were conducted at the culmination of the treatment to help explain the quantitative findings. The quantitative findings were collected before, throughout, and at the culmination of the treatment.

Research Question One: What effect does the use of a digital word wall have on students' vocabulary acquisition when compared to the use of a non-digital word wall?

To answer this question, two intact groups were used (Class A and Class B). The independent variable was the word wall; one group received instruction on the digital word wall and the other group received instruction on the non-digital word wall. At the three week mark, the groups switched instructional methods. Two pretests were administered to both groups at the onset of the study. One pretest was a multiple-choice assessment (Graves, 2009) with three choices for each question (see Appendix F). The other pretest was termed the vocabulary knowledge scale pretest, was validated by Wesche and Paribakht (1996), and was found to be an accurate measure of student knowledge (see Appendix E).

For the first three weeks, the students in Class A were instructed with the digital word wall. The second intact group, Class B, was instructed with the non-digital word wall. At the three week mark, students in both classes were tested on the Greek and Latin roots they had learned. Then, teachers switched instructional methods to account for the teacher-level confounding variables that may have interacted with the independent variable.

For the second three weeks, the students in Class A were instructed, on the second set of Greek and Latin roots, with the non-digital word wall. The students in Class B were instructed, on the second set of Greek and Latin roots, with the digital word wall. At the end of the six week period, post assessments were administered. The posttests from the three week mark and the six week mark were scored and analyzed in

order to determine what effect the digital word wall had on students' acquisition of vocabulary words.

According to Huck (2008), the dependent variable is that which "is of interest to the researcher" as well as that which "serves as the target of the researcher's data collection efforts" (p.9).The two dependent variables in this study were the vocabulary knowledge scale assessment and the multiple-choice assessment that the students took at the onset, the three week, and the six week points of the study.. The distal dependent variable was the vocabulary knowledge scale assessment. The proximal dependent variable was the multiple-choice assessment.

Research Question Two: To what extent do students retain knowledge of the vocabulary words when using the digital word wall when compared to the non-digital word wall?

As was mentioned in the above section, two intact classrooms were studied. The focus in the second research question was retention of vocabulary knowledge. The independent variable was the word wall. One group received instruction on the digital word wall and the other group received instruction on the non-digital word wall. At the three week mark, the groups were assessed. Teachers then switched instructional methods. Students were assessed again at the end of the six weeks. Finally, students were also tested two weeks later (at the eight-week mark) for retention of vocabulary knowledge. Again, the two dependent variables in this study were the vocabulary knowledge scale assessment and the multiple-choice assessment that the students took at the onset and culmination of the study. Specifically, the distal dependent variable was

the vocabulary knowledge scale assessment and the proximal dependent variable was the multiple-choice assessment.

Research Question Three: What are teachers' and students' perceptions of the digital word wall?

The researcher was specifically interested in determining the degree to which the digital word wall could be considered an engaging, motivating tool for acquiring and retaining vocabulary. After the treatment was administered and the posttests were given at the six week mark, the researcher conducted the interviews. Those interviews were analyzed using qualitative methods. Both of the participating teachers were interviewed with a semi-structured interview protocol (see Appendix H). To determine which students to interview, the researcher employed a purposeful sampling technique. Specifically, the researcher utilized a nonprobabilistic sampling technique in the Statistical Package for the Social Sciences, or SPSS. The researcher extracted the extreme cases and interviewed two students from the extreme upper end of the data and two students from the lower end of the data. The researcher then employed a medial case nonprobabilistic sampling technique and found two students from the medial section to interview. This delineated a total of six interviews.

Six students were chosen by the aforementioned quantitative method of nonprobability sampling with a semi-structured interview protocol (see Appendix G). Interviews were recorded using a digital audio recorder. At that point, the researcher began the process of transcription. The researcher thematically analyzed the transcripts in order to identify major themes or concepts which existed in the data set (Ezzy, 2002). No apriori categories were established before beginning the transcription process.

Therefore, thematic analysis was appropriate for this data. Although the researcher did have an overall issue of interest, specific themes and concepts were not be decided prior to the coding process (Ezzy, 2002). Moreover, the researcher allowed the themes and concepts to emerge from the interview data. An open coding process was employed due to the fact that the researcher was exploring the data and coding for meaning, feelings, and action (Ezzy, 2002).

Role of the Researcher

When laying out the plans, it was important to consider my influence on the study being conducted. It was anticipated that my personal experiences and training were going to influence the approach taken and the methodology utilized (Creswell, 2009).

At the time of the study, I had been a teacher at Green Brook Elementary School for seven years. I had always been bothered by the lack of rigor in the area of vocabulary instruction in the realm of Greek and Latin roots. Vocabulary acquisition and retention had been an interest of mine for quite some time. Due to my role as a teacher in the Green Brook community, I was familiar with the other teachers, students, administration, and parents. In fact, I had watched many of the students grow up. Moreover, I was teaching at Green Brook when that particular class of fifth graders was in kindergarten. The strong connection that I felt with those students most likely contributed to my desire to help make vocabulary instruction as good as it could be for them. The teachers who were participating in the study and I had worked together for seven years. I had known each of them for longer than that. Mrs. Lillian and I were sisters-in-law and I did my student teaching exercises in the classroom next to Mrs.

Narris. At the time of the study, we had worked together as an effective group for many years. The administration in place at the time of the study had been at Green Brook for three years. They helped encourage stellar curriculum and were immediately open to allowing me to conduct the study in the school. Several parents and I had previously established relationships as I had taught many of their older children. As we all (students, teachers, administration, and parents and I) had close relationships, I anticipated being able to gain significant information from interviews due to the connection which already existed. In actuality, the relationships gave the interviewee and me a place to begin and an established level of comfort.

While the benefits to these close relationships were strong, there were several limitations to consider as well. During the interview process, students and teachers may have felt obligated to tell me, as the researcher, what they thought I wanted to hear. I did my best to convince them that they could be completely honest with me. Also, the parents may have felt obligated to allow their children to participate in the study. In an attempt to alleviate this issue, I assured parents and students that there was absolutely no penalty for not participating. I also reminded them that if they chose to participate, they could withdraw at any time.

Research Context

Research setting. I attempted to conduct research within the social and historical context in which it occurred. Students were not taken out of their classrooms. Instead, the teachers in each classroom were given additional educational tools (knowledge of the digital word wall and the non-digital word wall). I observed teachers and students, while they worked with word walls, at least once a week. An implementation fidelity

checklist was created and utilized for the purpose of observing the students and teachers as well as ensuring the fidelity of the instruction (See Appendix I). The research study took place at Green Brook Elementary School, a public school located in a suburban area outside of a large southeastern city in the United States. Green Brook served students in grades pre-kindergarten through five and had a total of six hundred fifteen students. The student to teacher ratio was 1: 17.08. There were a total of 44.23% of students receiving free or reduced lunch. The demographics of Green Brook were as follows: males comprised 50.24% of the school population, 36.75% of the student population was Black, 55.75% of the student population was White, 3.58% of the student population was Hispanic, 3.25% of the student population was Asian/Pacific Islander, and 0.49% of the student population was American Indian/Alaskan (nces.ed.gov).

The research site was chosen for several reasons. First of all, I had taught at Green Brook Elementary School for seven years and had always had the desire to improve access to a quality education for all of students, regardless of race, creed, or socioeconomic status. Also, choosing Green Brook was a matter of convenience. I had an exceptional working relationship with the teachers at Green Brook and the entire fifth grade team was willing to participate in the research study. I had also maintained a close relationship with administration. Finally, I was quite familiar with the school, the students, the teachers, and the administration. This provided me with profound access. However, I did have to maintain awareness of my involvement in the school community and my relationships with people in the study. I examined the probable impact of participating in the study on the students and teachers by analyzing previously

conducted research in the areas of vocabulary, technology, and Greek and Latin root study.

Participants. The type of sampling procedure utilized in the study was a convenience cluster sampling. The participants were labeled as a convenience sample due to the fact that there were no screening criteria set up to ensure that the sample had specific characteristics (Huck, 2008). The population which corresponded to the convenience sample was quite abstract and was considered to include individuals comparable to those studied in the sample (Huck, 2008). Admittedly, this was indeed a form of bias (Patten, 2005).

Adult participants. As a member of the Green Brook Elementary School community, I had access to teachers and students through face to face interaction as well as access to teachers by email. I had permission from the principal to conduct the experiment and gained approval from the University Institutional Review Board, IRB, as well. After gaining approval from the IRB, I met with the two participating teachers in order to have an introductory meeting. The purpose of the meeting was to explain the study and what it would entail. I also passed out consent forms. Moreover, I followed up with emails which encouraged the teachers to participate and thanked them for their interest.

One of the teachers, Mrs. Lillian, was a White, 36 year old female. She had taught for 12 years in the southern United States. She had held the positions of fifth grade teacher and reading specialist. She had a Bachelor's and a Master's degree in elementary education. The other teacher, Mrs. Narris, was a White, 52 year old female. She had taught for 20 years in the south. Mrs. Narris had previously taught fourth and

fifth grades. She was National Board Certified as a Middle Childhood Generalist. She held a Bachelor's and a Master's degree in elementary education as well as 30 hours above her Master's degree in education.

Student participants. The student participants had previously been assigned to the selected teachers by the administration. These classroom assignments were reflective of the overall ethnic and socioeconomic status makeup of the entire school. Each class had several exceptional students but was by and large composed of average students. Ms. Lillian had two resource students and one gifted and talented student; she had a total of 24 students (the data from 22 students was included in the study). Ms. Narris had one resource student and six gifted and talented students. She had a total of 23 students (the data from 21 students was included in the study). As morphemic analysis has been found to be appropriate for students in grades four and higher (Nagy, Diakidoy, & Anderson, 1993; White, Power, & White, 1989), the fifth graders in this study were most likely at the appropriate cognitive level. There were 47 fifth grade students who participated in the study. The data from 43 of those students were included in the study. After I gained consent from the Institutional Review Board, I sent both consent and assent forms home with the students for their parents to review, sign, and return. Students and parents were made aware of the voluntary nature of participation in the study.

Data Collection Methods and Procedures

There were two intact groups in the study. The data collection methods and procedures were the same for both groups. The following offers insight into what was collected, how this information was collected, and the procedures that were followed for

teaching the Greek and Latin root words with a digital word wall and a non-digital word wall.

There were two main categories of data that were collected: interviews and assessments. Interviews were conducted with teachers and students at the culmination of the study. Assessments included both a multiple-choice assessment, informed by Graves (2009) as well as a vocabulary knowledge scale assessment (Dale, 1965; Stahl & Bravo, 2010; Wesche & Paribakht, 1996). The assessments were given before the treatment, at the three week mark, and at the six week mark. The assessments were given once more at the eight-week mark in order to assess retention of the vocabulary knowledge.

Research questions one and two. Implementation fidelity was used to measure how closely the teachers adhered to the instructional guidelines for each type of word wall (the digital word wall as well as the non-digital word wall). A checklist with the important elements of instruction was utilized by the researcher once a week. Days of the week in which the observations were conducted varied and were recorded by the researcher. The checklist was primarily used to ensure that the instructional techniques were being instituted properly. This aided in the detection of treatment diffusion (see Appendix I for the implementation fidelity checklists).

Vocabulary knowledge scale. The vocabulary knowledge scale assessment was consistent with Dale's (1965) incremental stages of word learning (See Appendix E) and was the distal dependent variable as it only contained the Greek and Latin roots taught. This measure allowed each student to construct an independent response demonstrative of his or her personal knowledge of the Greek and Latin roots. The

vocabulary knowledge scale assessment was not designed to measure words in multiple contexts or the lexical nuances of a word (Stahl & Bravo, 2010). Wesche and Paribakht (1996) used the measure with ELL students and found that it was sensitive enough to measure incremental gains in vocabulary knowledge.

Reliability and validity of the vocabulary knowledge scale. Reliability and validity must be established within the instrumentation used in the study. Reliability can be likened to the word consistency and is evaluated from the varying perspectives of different researchers (Huck, 2008). Validity can be thought of as measure of accuracy (Huck, 2008). As Huck (2008) determines, "a measuring instrument is valid to the extent that it measures what it purports to measure" (p. 88). Wesche and Paribakht (1996) found that there was a high correlation between the self-report and the actual score for demonstrated knowledge. In fact, they found the correlation to be above .95. Wesche and Paribakht also found a high level of a test-retest reliability (r = .8). Thus, the vocabulary knowledge scale had previously established reliability and validity. However, the researcher did have to establish reliability and validity for the multiple-choice assessment as it was created by the researcher, specifically for this study.

Multiple- choice vocabulary assessment. Validity, measuring what you purport to measure (Wolcott, 1990), is essential in a research study. In order to maintain validity in the vocabulary assessment, I constructed a pretest and posttest with the selected Greek and Latin root words. Thus, the roots assessed were the roots that the students studied. Graves (2009) suggests that an option for testing reading vocabulary is to create a vocabulary assessment to fit the needs of the words that the teacher or researcher has selected. Graves (2009) suggests the following guidelines for creating a multiple-

choice vocabulary assessment: (1) create three multiple-choice options for each root word (2) keep things simple; the question should only address the word that is being tested (3) the answer should be clear and succinct; the words in the answer should be simpler than the tested word (4) the two distractors should be clearly incorrect (5) all three alternatives should be around the same length and utilize the same syntax; the creator should avoid alternative answers that are humorous or obviously incorrect. I took Graves (2009) suggestions into account when I created the multiple-choice assessment.

Reliability and validity of the multiple-choice assessment. Varying methods of reliability address the issue of consistency from different perspectives (Huck, 2008). In fact, a high measure of stability does not indicate that the internal consistency measure would be high, and therefore, it is best to have several approaches to reliability in the same study (Huck, 2008). Two types of reliability were established for the multiple-choice assessment. First, the test-retest measure of reliability was utilized; the researcher used the same instrument to test students within a period of time. The multiple-choice assessment was given to a group of students once and then was given a week later. The researcher correlated the two collections of data, indicated by Pearson's r or Pearson's correlation, to determine the test-retest reliability coefficient. This addressed the subject of stability over a period of time (Huck, 2008). The test-retest measure of reliability over a one week period was .925.

Second, the researcher determined the degree of internal consistency reliability, consistency across the different questions in the instrument, for the multiple-choice assessment (Huck, 2008). High internal consistency reliability was described as when

different parts of the test were able to weave together well or were said to assess the same thing (Huck, 2008). The approach to determining internal consistency in this study was Cronbach's alpha. In fact, the internal consistency of the multiple-choice assessment was moderate (Cronbach's alpha = 0.716).

Content validity was established for the multiple-choice assessment in order to determine if the construct of vocabulary knowledge was accurately assessed with the aforementioned instrument. As described by Huck (2008), the concern about the instrument covering the intended material translates into a concern of content validity. The subjective opinion of experts either establishes or fails to establish the content validity of the instrument (Huck, 2008). Three experts were contacted to review the validity of the multiple-choice assessment: two literacy college professors as well as a classroom teacher of the grade which was studied. After comparing responses of these experts, several changes were made to the content of the multiple-choice assessment. First of all, the multiple-choice options for *antisocial* were changed from: (a) around social people, (b) across from social areas, and (c) the opposite of being social to (a) one who enjoys being around people, (b) one who is afraid of people, and (c) one who doesn't enjoy being around people. This change was made based on the suggestion of one of the experts that part of the word (social) should not be in the definition choices. The multiple-choice options for *audiology* were also changed. They were changed from: (a) a branch of science concerned with listening, (b) a branch of science concerned with hearing, and (c) a branch of science concerned with moving to (a) a branch of science concerned with seeing, (b) a branch of science concerned with hearing, and (c) a branch of science concerned with moving. This was due to the researcher deciding that the

definitions of *listening* and *hearing* were too similar. Finally, the multiple-choice options for *terra-cotta* were changed from: (a) a heavenly flower pot, (b) a baked-earth flower pot, and (c) a religious flower pot to (a) a metal flower pot, (b) a baked-earth flower pot, and (c) a plastic flower pot. This change was made based on the classroom teacher's suggestion that the plastic and metal would be better foils for the students. After these changes were made, all three consulted experts believed the multiple-choice assessment to have content validity.

Research question three. The qualitative portion of the study was a "*basic* or *generic qualitative study*" as this portion of the study exemplified the characteristics of qualitative research but did not attempt to build a grounded theory nor was it an in-depth case study (Merriam, 1997; p. 11; emphasis in original). According to Merriam (1997), this is the most common form of qualitative research in education. It was used by the researcher in order to attempt to discover and understand the perspectives of the people involved in the study (Merriam, 1997). Interviews of teachers and students were conducted at the culmination of the study. Six students were chosen by the aforementioned quantitative method of nonprobability sampling with a semi-structured interview protocol (see Appendix G). Interviews were recorded using a digital audio recorder and were then transcribed. The researcher used thematic analysis to identify major themes or concepts which existed in the data set (Ezzy, 2002). The researcher allowed the themes and concepts to emerge from the interview data. Moreover, the researcher used an open coding process to explore the data for meaning, feelings, and action (Ezzy, 2002).

Validity of the interviews. To ensure trustworthiness and validity in the qualitative realm of the study, several methods were employed. Glesne (2006) suggested a number of ways in which a researcher can amplify trustworthiness and validity. The researcher used the following of Glesne's (2006) methods to strengthen trustworthiness and validity: triangulation, peer review and debriefing, clarification of the researcher's bias, and member checking. It is important to note that triangulation methods were in place in this study. In fact, there were multiple data collection methods. For instance, there were two pre and post assessments as well as student and teacher interviews (Glesne, 2006). Peer review and debriefing continuously took place as the researcher asked the members of the dissertation committee to review data, revise chapters, and provide comments. These comments helped the researcher to keep her biases in check. The researcher discussed her biases in an earlier section of chapter three of this study. Member checking was also used with the teachers as well as with the students interviewed. After the transcript was composed, the researcher shared the transcripts with the interviewees. The researcher asked the interviewees to read over the transcripts in order to check that their words were accurately represented. Findings were shared with those involved in the study.

Methods of Instruction

The fifth grade teachers at Green Brook Elementary School had previously taught one Greek or Latin root word per week for the preceding seven years. Each teacher had his or her own manner of teaching these roots. However, the general practice was to put one root on the board on Monday. Then, the teacher would discuss the meaning of the root and provide students with an example of the root (and meaning

of that example). It became a homework assignment for students to find one example Tuesday, Wednesday, and Thursday. Students had to write the example and meaning of that example. For instance, if the root was co, the student might find the example *cooperate* and write that it means *to work together*. To increase the rigor for this study, the researcher determined that the students would focus on three predetermined root words per week for the duration of six weeks. The study of these three root words grew in magnitude as students had access to and interacted with many words containing the Greek and Latin roots. For example, while students were studying the root word *co,* they came across many words such as: *coworker, cohabitate, co-captain,* and *coauthor*. The student, through studying the root, was able to determine the meaning of the new word by using word parts. For example, the student was able to realize, after studying that *co* means t*ogether*, that *co-authors* are people who *write a book together*. In an effort to increase the ability of others to replicate the study, each teacher followed established guidelines (see the non-digital word wall and digital word wall methods of instruction below).

The non-digital word wall method of instruction.

Introduction. The introduction was the first part of the students' daily vocabulary instruction and typically took about 10 minutes. However, on Mondays the introduction tended to be longer. The teacher had to spend more time on the introduction the first time the students saw the roots. This was where the three Greek and Latin root words were introduced for the week. For example, on the first Monday, the teacher introduced *co*, *inter*, and *mis*. The teacher distributed three empty Frayer models per group; the students wrote down each root and meaning of the root as the

teacher discussed them. The interactive white board (see definition of terms in chapter one for a definition of this phrase), was used to display each of the modified Frayer models that I created for the students to have an example of expectations (See Appendix D for the modified Frayer models that were used). In effect, as the teacher was discussing the root *inter* the group of students was copying down *inter* in the oval for the root and *between/among* in the rectangle for meaning. The class also collectively participated in a discussion of the root words.

Collaboration. Students then got together, in groups of four to five, for 10 to 15 minutes so that they could collaborate, plan, and share ideas. Students needed access to dictionaries. The teachers found that it worked best to distribute two to three dictionaries per group during this part of the lesson. Then, the students created illustrations, found examples of words that contained the Greek and Latin root words, definitions, and sentences in order to add them to their non-digital word wall. The students created three Frayer models a day (Monday through Friday). So, if the root words were *co*, *inter*, and *mis*; the students may have found *coworker*, *interact*, and *misnomer* on Monday. Students then created a Frayer model for each of those words. In each of the models, the students would have written the root word, the meaning of the root word, an example of a word that had the root as a word part, an illustration of that word, and a sentence which used that word properly.

The teacher circulated among groups while the students were working. There were instances where the teacher had to stop and have a mini-lesson when she noticed that several groups were making a common mistake. For example, a common mistake that the fifth graders made was that they found words that were unrelated to the Greek

or Latin root (Graves, 2009). To illustrate this concept, the following example is provided: students may have found the word *mister* to illustrate the Greek root of *mis*. This, of course, would be incorrect because if one was to take away the prefix *mis* one would be left with *ter* which has no meaning on its own. In fact, the word *mister* has nothing to do with the meaning of *mis*, something wrong or bad.

Conclusion. The conclusion of the lesson was supposed to take about ten minutes. However, teachers found that this part of the lesson tended to take longer. The groups shared their work with their classmates in the following manner. The teacher flipped to the first root word on the interactive white board (the original example that the teacher began the lesson with). Each group then shared their Frayer model for that root word. Students used the following format to share their work: "Our root is_____. The meaning of our root is _____. Our example is _____. Our sentence is _____. Our illustration is _____." For example, "Our root is co. The meaning of our root is together. Our example is cooperate. Our sentence is: the two friends cooperated on a big project in school. Our illustration is of two friends girls leaning over a table and working on a project." The modified Frayer models which were not duplicates (meaning another student had previously displayed it) were displayed on the word wall at the front of the room. Students then had these models to refer back to during class.

The digital word wall method of instruction.

Introduction. As with the non-digital word wall, the introduction typically took 10 minutes. However, as with the non-digital word wall instructional method, the teacher was more likely to need additional time on Mondays for the introduction. The

digital word wall instruction was similar to the non-digital word wall instruction. The difference was the addition of the Web 2.0 tools. The three Greek and Latin root words were introduced for the week. For example, on the first Monday, the teacher introduced *co, inter,* and *mis*. The interactive white board was used to display each of the modified Frayer models that the researcher had created for the students to have an example of expectations (See Appendix D for the modified Frayer models that were used). The class then participated in a discussion of the root words.

Collaboration. The collaboration portion of the digital word wall instruction took place in the computer lab at the school. Students had ten to fifteen minutes, Monday through Friday, to get together in their groups of four to five students for five to ten minutes in order to collaborate. This was when students began to find words (using tools on the Internet) which had the Greek and Latin roots embedded within them. Students used the digital word wall, the wiki, to create and post their digital modified Frayer models. (See Appendix D for the modified Frayer models that were used). For the duration of the time, students were looking for and adding illustrations, examples of words that contained the Greek and Latin root words, definitions, sentences, etc. to their wikis. As students were discussing what images to utilize (images included photographs as well as clip art) they were associating images with the words; this process was extremely beneficial to student learning (Arten & Nilsen, 2009; Narkon, Wells, & Segal, 2011).

Conclusion. The lesson plans called for the teacher to spend about 10 minutes at the culmination of the lesson to allow students to review and share their own work. However, the conclusion portion of the lesson often ran over the allotted time due to the

time needed for each group to present. The teacher used the interactive white board to display the wiki so that students could present their modified Frayer models. Students had to use the following format to describe their Frayer models: "Our root is_____. The meaning of our root is _____. Our example is _____. Our sentence is _____. Our illustration is _____." For example, "Our root is co. The meaning of our root is together. Our example is cooperate. Our sentence is: the two friends cooperated on a big project in school. Our illustration is of two friends girls leaning over a table and working on a project."

Data Analysis

A two-way repeated measures ANOVA was used to analyze the data. The researcher used version 19 of SPSS to analyze the data from the study. Each row in the data entry corresponded to a particular student. Students were then classified by class membership (Class A or Class B). Students in Class A were designated in SPSS with the numeral 1. Students in class B were designated as such with the numeral 2. Scores were entered for each student in the following areas: pretests, posttests, and eight-week posttests. Pretests scores included: the multiple-choice pretest on the digital words, the multiple-choice pretest on the non-digital words, the vocabulary knowledge scale preassessment on the digital words, and the vocabulary knowledge scale preassessment on the non-digital words. Posttest scores were entered for the following assessments: the multiple-choice posttest on the digital words, the multiple-choice posttest on the non-digital words, the vocabulary knowledge scale assessment on the digital words, the vocabulary knowledge scale assessment on the non-digital words. To measure for retention of vocabulary knowledge, scores for the eight-week measurement were

recorded for: the multiple-choice eight-week assessment on the digital words, the multiple-choice test on the non-digital words, the vocabulary knowledge scale assessment on the digital words, the vocabulary knowledge scale assessment on the non-digital words. Repeated measures on the within subjects factor (time) were the pre and post tests. The repeated measures on the between subjects factor (word wall) were digital and non-digital.

For each of the first two research questions, there was a set of three null hypotheses. The first null hypothesis was the main effect, time: pretest versus posttest scores were equal to one another. In other words, there was not any growth of vocabulary skills from the preassessment to the postassessment. The main effect for the second factor, word wall: digital versus non-digital scores were equal to each other. In other words, there was not any difference in the scores with regards to digital versus non-digital means of instruction. The third null hypothesis was that the two factors did not interact or that the difference between the groups at pretest is equal to the difference between the groups at posttest.

In order to use the two-way repeated measures ANOVA, there were several assumptions that had to be met. The assumption for sphericity had to be met. For this study, it was best to examine Mauchly's to test the assumption of sphericity. Mauchly's Test of Sphericity is a statistical test of equal variances. If Mauchly's indicated unequal variances, we used a corrected ANOVA. Specifically, the researcher used the Greenhouse-Geisser correction. When examining Mauchly's Test of Sphericity, the researcher looked at the chi squared box; it was used due to the fact that the grouping variable was nominal.

Limitations

The limitations of the methodology, a mixed methods approach, or more specifically an explanatory mixed methods approach, had to be considered. It is often problematic to analyze the results of a study from differing forms (Creswell, 2009). Creswell (2009) also determined that it can be difficult for the researcher to determine how to realign results when inconsistencies between quantitative and qualitative information arise.

However, when issues arise, all is not lost. Creswell (2009) maintained that the solution, or solutions, to the problem of inconsistency between quantitative and qualitative information can be mitigated. It may simply entail going back to the research site and collecting further data, analyzing the original data once more, gathering additional understanding and awareness from the discrepancy in the data, or designing a new project which could address the disparity (2009).

There were several possible threats to internal validity. First, the Diffusion of Treatment effect could have affected this study. This could have happened if the students in the digital group shared their wiki (the digital word wall) with those students in the non-digital group at lunch, recess, or after school. This could have possibly lessened the gap in the posttest scores between the digital and non-digital word wall groups. This would have made the digital word wall seem less effective than it actually was. The second possible threat to internal validity was the Compensatory Rivalry effect in which the students not receiving instruction with the digital word wall may have gotten competitive and studied extra hard. This could have led to the students doing better than they might have done otherwise (Patten, 2005). The third threat to

internal validity that may have been an issue here is the Resentful Demoralization effect. This could have happened if the non-digital word wall group got upset and jealous over the fact that they did not have access to the digital word wall. They may have given up and not performed to the best of their abilities (Patten, 2005). This would have exaggerated the gap between the pre and posttest scores with the digital and non-digital word walls, and made the digital word wall seem more effective than it actually was (Patten, 2005). The fourth possible threat was treatment replication. This threat is the one that was the most significant as it referred to the amount of time that each group spent with each type of instruction. Students only spent three weeks with the digital word wall and three weeks with the non-digital word wall. Possible threats one through three may have been neutralized by the fact that both groups eventually experienced both methods of instruction. To alleviate the effects of threat four, more time would be needed for students to more fully experience each type of instruction.

The major threat to external validity in the study was pretest sensitization. This threat is when students perform better on the posttest because they experienced the pretest first (Patten, 2005).

Systemic bias may make it quite difficult to draw concise conclusions from the statistical results. The systemic bias may be in the form of: practice effect (briefly addressed above) with students performing better on subsequent assessments; fatigue effect which is when students get bored and perform less well; also, things can become confounded with participants learning vocabulary outside of the study (Huck, 2008).

Summary

An explanatory mixed methods approach was utilized in this study. In fact, the qualitative component of the study was used to explain the quantitative findings. Participants included 43 students. There were 22 students in Class A, and 21 students in Class B. Two teachers also participated. The study took place in an elementary school located in a suburban area of the Southeastern United States.

Class A, which consisted of Ms. Lillian and 22 students, began with the digital word wall method of instruction. Class B, which consisted of Ms. Narris and 21 students, began with the non-digital word wall method of vocabulary instruction. These classes received instruction in the specified manner for three weeks. At the three week mark, the teachers switched instructional methods. In effect, each teacher taught both methods, and each student in the study received instruction in each method.

The quantitative components of the study consisted of: (1) an implementation fidelity component, (2) a preassessment and postassessment in the form of a multiple-choice test, and (3) a preassesssment and postassessment in the form of a vocabulary knowledge scales assessment. A nonprobabilistic sampling technique was employed to determine which students to interview. This led to the qualitative portion of the study.

There were two groups of interviews conducted in the study: (1) six of the participating students and (2) both of the participating teachers. Interviews were conducted individually and followed a semi-structured protocol. Thematic analysis was used to determine themes within the data. Open coding was the method the researcher utilized in order to determine those themes.

CHAPTER 4: RESEARCH FINDINGS

The purpose of this mixed methods study was to determine if digitizing the word wall had a positive effect on vocabulary acquisition, retention, and motivation. Students participated in six weeks of vocabulary instruction on Greek and Latin roots. Each student experienced three weeks of vocabulary instruction with a non-digital word wall and three weeks of vocabulary instruction with a digital word wall. Two classrooms were used and several forms of data were collected. The participating students took pretests and posttests in two formats: the multiple-choice assessment and the vocabulary knowledge scale assessment. Students were assessed four times with the two assessments. The first assessments were given before the instruction was begun (the preassessments). The second assessments were given at the three-week mark to test for vocabulary acquisition of Greek and Latin roots. The next set of assessments was also to test for acquisition and was given at the six-week mark. The last set of assessments was given at the eight-week mark in order to test for retention of the Greek and Latin root words. Interviews were also conducted. In fact, six of the participating students and the two participating teachers were interviewed.

The findings are reported in three sections which correlate with the three research questions that were posed. The first section addresses the research question: *What effect does the use of a digital word wall have on students' vocabulary acquisition when compared to the use of a non-digital word wall?* The results of the multiple-

choice assessments are addressed first. Then, the results of the vocabulary knowledge scale assessments are presented.

The second section addresses the research question: *To what extent do students retain knowledge of the vocabulary words when using the digital word wall when compared to the non-digital word wall?* Again, the results of the multiple-choice assessment are presented first with the results of the vocabulary knowledge scale assessment presented second.

The third section addresses the research question: *What are the teachers' and students' perceptions of the digital word wall?* The first part of this section deals with the teachers' perceptions; a summary of each teacher's interview is presented and a thematic analysis sums up the two interviews. The second part of this section deals with the students' perceptions. Again, there is a summary of each student's interview with a thematic analysis of student interview results at the culmination of this section. Research Question One: What effect does the use of a digital word wall have on students' vocabulary acquisition when compared to the use of a non-digital word wall?

The students were given two types of pretests before receiving any instruction in Greek and Latin roots. The first pretest was a multiple-choice assessment (Graves, 2009) and the second was a modified vocabulary knowledge scale assessment (Dale, 1965; Stahl & Bravo, 2010; Wesche & Paribakht, 1996). The students were in two groups of intact classes: Class A and Class B. The first group, Class A, participated in instruction in the digital word wall for the first three weeks. The second group, Class B, participated in instruction in the non-digital word wall for the first three weeks. During the first three weeks, both groups covered the following Greek and Latin roots: *co,*

inter, mis, semi, terra, port, audi, *dict,* and *meter*. At the end of the first three weeks, both groups were assessed on the aforementioned roots. The students took two assessments, the multiple-choice and the vocabulary knowledge scale.

After students were assessed on the first nine Greek and Latin roots, teachers switched instructional methods for the duration of weeks four, five, and six. The students in Class A, who had learned the previous Greek and Latin roots with the digital word wall, had to learn the new set of Greek and Latin roots with the non-digital word wall. The students in Class B, who had previously learned the first nine Greek and Latin roots with the non-digital word wall, had to learn the new set of Greek and Latin roots with the digital word wall. The students focused on the following Greek and Latin roots for weeks four, five, and six*: geo, spec/spect, hydro, sub, graph, prim/prime, omni, micro,* and *anti*. At the end of the sixth week, students again took the multiple-choice and vocabulary knowledge scales assessments on the second set of Greek and Latin roots.

At the culmination of the six weeks, each student had learned half of the Greek and Latin roots with the aid of the digital word wall and half with the aid of the non-digital word wall. In order to allow the reader to become more familiar with the data, what follows is a look at the multiple-choice and vocabulary knowledge scale data. First, the multiple-choice descriptive statistics are presented. Then, the results of the multiple-choice Two-Way Repeated Measures ANOVA are discussed. Third, the descriptive statistics of the vocabulary knowledge scale descriptive statistics are shown. Finally, the results of the vocabulary knowledge scale Two-Way Repeated Measures ANOVA are described.

Multiple-choice assessment results. The lowest possible score on the multiple-choice assessment was zero; the highest possible score was 18. The results of the multiple-choice assessment showed a slight difference in mean gains between the digital and non-digital word walls (See Table 2). When students utilized the digital word wall, there was a mean growth of 6.26; the mean gain with the non-digital word wall was 6.07. When looking at means, the growth in vocabulary acquisition was slightly larger when students had the mediating tool of the digital word wall.

Table 2: Multiple-choice Descriptive Statistics

	Mean	Median	Mode	SD	Range
Digital Pretest	10.23	10	8	3.19	12
Digital Posttest	16.49	17	18	1.94	10
Non-Digital Pretest	10.05	10	8	3.66	14
Non-Digital Posttest	16.12	17	18	1.85	9

Before looking at the results of the Repeated Measures ANOVA, the assumption for sphericity must be met. Mauchly's test of sphericity indicated that there were unequal variances ($p < .001$). As a result, a corrected measure of the ANOVA was used; the researcher read the Greenhouse-Geisser correction. As was mentioned in chapter three, there were three hypotheses. The first null hypothesis is the main effect, time: pretest versus posttest are equal to one another. In other words, the first null hypothesis states that there was no growth of vocabulary skills from the preassessment to the postassessment. The main effect for the second factor, word wall: digital versus non-digital are equal to each other; there will not be any difference in the growth of scores in

regards to digital versus non-digital means of instruction. The third null hypothesis is that the two factors do not interact.

Table 3: ANOVA Summary Table for the Multiple-choice Results

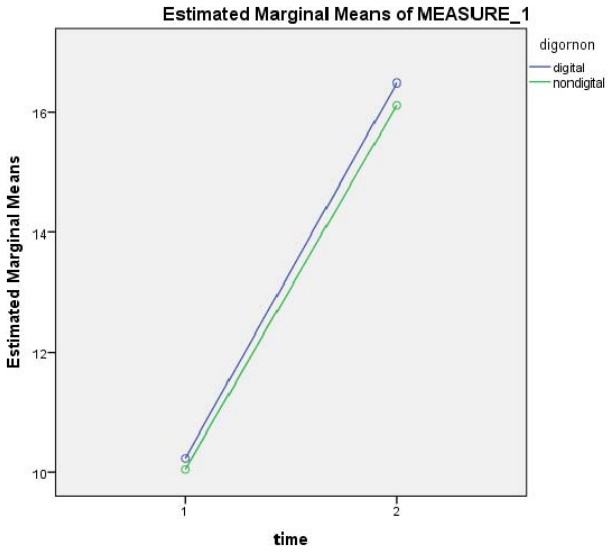
	df	SS	MS	*F*
Time (Pretest and Posttest)	1	1633.14	1633.14	312.14*
Error	84	439.49	5.23	
Word Wall (digital or non)	1	3.35	3.35	.329
Error	84	855.26	10.18	
Time x Word Wall	1	.37	.37	.071

*$p < .01$.

The first null hypothesis was rejected. There was a significant main effect for time. F (1, 84) = 312.14, $p < .001$. This means that the post test scores were significantly greater than the pretest scores. The partial eta squared was equal to .788; therefore, 79% of the variance of the scores can be explained by time. The second null hypothesis was retained. The main effect for the second factor, word wall: digital versus non-digital was not significant, F (1, 84) = 3.35, p= .568. This means that there was not a significant difference between the groups based on type of instruction (digital versus non-digital word wall). The interaction effect was also not statistically significant, F (1, 84) = .071, p=. 79. This means that there was not a statistical difference in the preassessment and postassessment score gains of the students when using the digital word wall compared to the students when using the non-digital word wall.

The following graph illustrates the aforementioned data. Both groups increased their vocabulary knowledge from pretest to posttest. Notice that the digital scores are slightly higher for both the pretest and the posttest. However, the difference was not large enough to be statistically significant. Finally, the interaction effect is illustrated. Although the difference between the groups at the time of the pretest is smaller than the difference between the groups at the posttest, the difference is not large enough to be statistically significant.

Graph 1: Multiple-choice Results



Vocabulary knowledge scale assessment results. When viewing the growth of means from pretest to posttest, the growth in vocabulary acquisition was larger when students had the digital word wall as their tool. The lowest possible score for the vocabulary knowledge scale assessment was zero; the highest possible score was 45. The results of the vocabulary knowledge scale assessment showed a difference in mean gains between the digital and non-digital word walls (See Table 4). The mean growth

when students had access to the digital word wall was 19.16 points. The mean gain when students used the non-digital word wall was 15.05 points.

Table 4: Vocabulary Knowledge Scale Descriptive Statistics

	Mean	Median	Mode	SD	Range
Digital Pretest	20.44	20	22	6.4	29
Digital Posttest	39.6	42	45	7.4	31
Non-Digital Pretest	20.88	20	18	5.35	22
Non-Digital Posttest	35.93	36	43	6.47	30

Again, the assumption for sphericity must be met. Mauchly's test of sphericity indicated that there were unequal variances ($p < .001$). As a result, a corrected measure of the ANOVA was used; the researcher read the Greenhouse-Geisser correction. The hypotheses are the same as for the multiple-choice assessment results. The first null hypothesis states that there is no statistical main effect for time, the pretest and posttest scores are equal; i.e. there will not be any growth of vocabulary skills from the preassessment to the postassessment. The second null hypothesis for the main effect for method of instruction, digital versus non-digital word walls are equal to each other; i.e. there will not be a statistically significant difference in groups in regards to digital versus non-digital means of instruction. The third null hypothesis is that the two factors (time and method of instruction) do not interact.

Table 5: ANOVA Summary Table for the Vocabulary Knowledge Scale Assessment

	df	SS	MS	*F*
Time (Pretest and Posttest)	1	12580.47	12580.47	633.97*
Error	84	1666.88	19.84	
Word Wall (digital or non)	1	112.33	112.33	1.78
Error	84	5307.21	63.18	
Time x Word Wall	1	182.15	182.15	9.18*

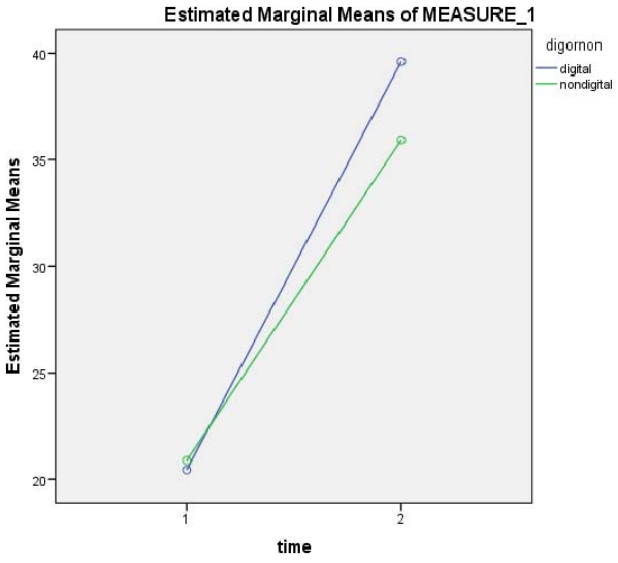
*$p < .01$.

In the case of the vocabulary knowledge scale assessment, the first null hypothesis was rejected. There was a significant main effect for time. F (1, 84) = 633.97, $p < .001$. This means that the vocabulary knowledge scale post test scores were significantly greater than the vocabulary knowledge pretest scores. The partial eta squared was equal to .883; therefore, 88% of the variance of the scores can be explained by time. The second null hypothesis was retained. The main effect for the second factor, word wall: digital versus non-digital was not statistically significant, F (1, 84) = 1.78, p= .186. This means that there was not a significant difference between the groups based on the word wall at pretest and postest. There was a significant interaction effect, F (1, 84) = 9.18, p= .003. Therefore, the difference in scores at the postassessment between the digital and non-digital word walls was significantly different from the difference in scores at the preassessment. In other words, there was a significant difference in the preassessment to postassessment score gains of the students when

using the digital word wall compared to the students when using the non-digital word wall.

The following graph illustrates the aforementioned data. Both groups increased their vocabulary knowledge from pretest to posttest. The interaction effect is also illustrated. The digital pretest scores are lower than the non-digital pretest scores. However, there is more growth for the digital group and those scores are higher than the non-digital at the six- week posttest mark. There is a significant difference in the preassessment and postassessment scores when using the digital word wall when compared to the scores of the students using the non-digital word wall (as is indicated by the cross over in the lines).

Graph 2: Vocabulary Knowledge Scale Results



Discussion. When looking at the descriptive statistics from Tables 2 and 4, it appears as though the digital word wall is the superior method of instruction. The means for both assessments (the multiple-choice and the vocabulary knowledge scale) were larger at the six week mark for the words the students learned with the digital

word wall. However, after running the Two-Way Repeated Measures ANOVA, the interaction effect for the multiple-choice assessment was not statistically significant. Interestingly, the results of the vocabulary knowledge scale assessment did show that there was a statistically significant difference in the vocabulary acquisition of students when using the digital word wall as compared to the non-digital word wall. The difference in results could be explained by the depth of knowledge required to answer the types of questions on the multiple-choice assessment versus the types of questions on the vocabulary knowledge scale assessment. Bloom's taxonomy is a helpful framework with which to analyze the depth of knowledge required to answer the questions on the two types of assessments used in this study.

The revised Bloom's taxonomy, the taxonomy used for this study, is two dimensional. Both the multiple-choice assessment and the vocabulary knowledge scale assessment fall into the same knowledge category: factual knowledge (Anderson & Krathwohl, 2001). Factual knowledge is the first category on the knowledge scale; it refers to knowledge of concrete information. Anderson at al. (2001) writes that this domain includes "knowledge of terminology" (p. 27).

The multiple-choice assessment positioned students on the first level of Bloom's taxonomy, *remembering*. Anderson and Krathwohl (2001) define the category of remembering as being able to "retrieve relevant knowledge from long-term memory" (p. 31). In the case of the multiple-choice assessment, students were merely required to possess the ability to recognize the appropriate answer as the correct answer was in front of the students.

The vocabulary knowledge scale assessment situated students on the second level of Bloom's taxonomy, *understanding*. Anderson and Krathwohl (2001) detail seven different subcategories of the cognitive process of understanding. The task required of students with the vocabulary knowledge scale assessment falls in the *exemplifying* subcategory; *exemplifying* is when students are given a concept or vocabulary word and involves a "constructed response" (p. 72) on the part of the student. When taking the vocabulary knowledge scale assessment, students were asked to exemplify their knowledge of the Greek or Latin root by choosing a word (from their personal repertoires, no words were provided for the students) that contained the Greek or Latin root and writing a sentence which illustrated the meaning of that word. This information came strictly from the student. In other words, when taking the vocabulary knowledge scale assessment, students had to demonstrate a more cognitively complex level of understanding. The vocabulary knowledge scale appears to be the more sensitive assessment.

The results indicate that the word wall, as a method of instruction, was an excellent way to instruct students on Greek and Latin roots. Posttest scores were much higher than pretest scores in both the multiple-choice and vocabulary knowledge scale assessments. When analyzing the difference in digital versus non-digital method of instruction, two findings are presented. First, there does not appear to be a difference in students' simple recall of Greek and Latin root meanings in the digital versus non-digital methods of instruction. This is demonstrated with the results of the multiple-choice assessment. Second, there does appear to be a difference in student learning with the digital versus non-digital methods of instruction when higher levels of thinking are

considered. This is indicated by the results of the vocabulary knowledge scale assessment and could be due to students' increased engaged and motivation when learning with the digital word wall. This is discussed further in chapter five.

Research Question Two: To what extent do students retain knowledge of the vocabulary words when using the digital word wall when compared to the non-digital word wall?

After a two-week hiatus, students were given two cumulative assessments on all the Greek and Latin roots and root words (inclusive of digital and non-digital roots and root words). The eight-week assessments were used in order to test how well students retained the knowledge of the Greek and Latin roots. The researcher wanted to determine if students retained vocabulary better when using the digital word wall.

This section will be similar to the first section in this chapter in that the multiple-choice results will be presented first and will be followed by the vocabulary knowledge scale assessment results.

Multiple-choice eight-week assessment results. Students were assessed at the eight-week mark to aid in determining if the digital word wall had a positive impact on retention of the learned vocabulary. While the means from the eight-week assessment fell from the six week assessment (indicating that students did lose some of the knowledge), the eight-week mean scores were still higher than the pretest scores. The mean score on the multiple-choice assessment (at the eight-week mark) for the words learned through the digital word wall was 16.30 and the mean for the non-digital word wall was 15.49. From the beginning to week eight, there was a mean gain of 6.07 points for the words that students learned with the digital word wall. The mean gain was 5.44 points for the words that the students learned with the non-digital word wall.

Table 6: Multiple-choice 8 Week Descriptive Statistics

	Mean	Median	Mode	SD	Range
Digital Pretest	10.23	10	8	3.19	12
Digital 8-Week Posttest	16.3	17	18	1.92	8
Non-Digital Pretest	10.05	10	8	3.66	14
Non-Digital 8-Week Posttest	15.49	16	18	2.96	12

The assumption for sphericity must be met. Mauchly's test of sphericity indicated that there were unequal variances ($p < .001$). As a result, a corrected measure of the ANOVA was used; the researcher read the Greenhouse-Geisser correction. As aforementioned, there were three null hypotheses. The first null hypothesis is the main effect, time: pretest versus posttest are equal; i.e. there will not be any growth of vocabulary skills from the preassessment to the postassessment. The main effect for the second factor, word wall: digital versus non-digital were equal; i.e. there was not any difference in the scores in regards to digital versus non-digital means of instruction. The third null hypothesis was that the two factors did not interact or that the difference between the groups at pretest was equal to the difference between the groups at posttest.

Table 7: ANOVA Summary Table for the 8 Week Multiple-choice Assessment

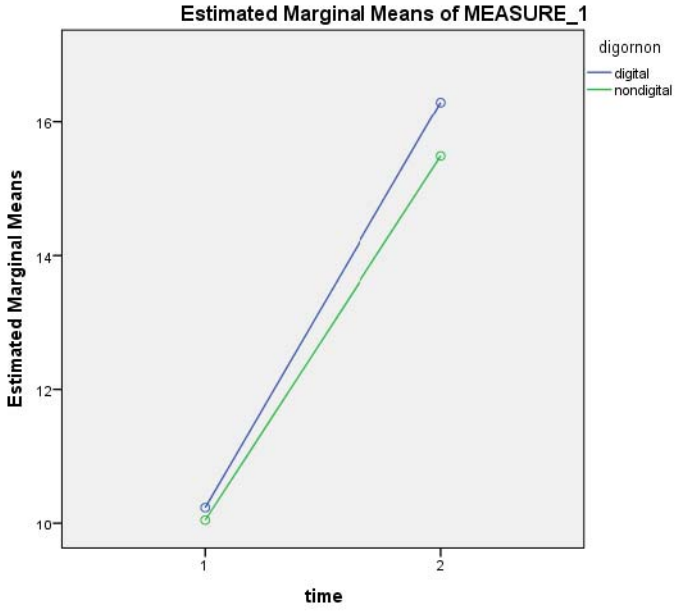
	df	SS	MS	*F*
Time (Pre and 8 wk Post)	1	1424.56	1424.56	266.69*
Error	84	448.7	5.34	
Word Wall (digital or non)	1	10.75	10.75	.847
Error	84	1066.7	12.7	
Time x Word Wall	1	4.24	4.24	.793

*$p < .01$.

The first null hypothesis was rejected. Even at the eight-week mark, there was a significant main effect for time. F (1, 84) = 266.69, $p < .001$. This means that the multiple-choice eight-week post test scores were significantly greater than the multiple-choice pretest scores. The partial eta squared was equal to .76; therefore, 76% of the variance of the scores can be explained by the intervention of the word wall. The researcher had to fail to reject the second null hypothesis. The main effect for the second factor, word wall: digital versus non-digital was not significant, F (1, 84) = .847, p= .36. This means that there was not a significant difference between the groups based on method of instruction. There was not a significant interaction effect, F (1, 84) = .793, p= .376. This means that there was not a statistical difference in the preassessment and eight-week postassessment score gains of the students when using the digital word wall compared to the students when using the non-digital word wall.

A graph was included below to aid in illustrating the aforementioned data. Both groups increased their vocabulary knowledge from pretest to eight-week posttest. The digital pretest scores are larger than the non-digital pretest scores. There is growth from pretest to eight-week posttest for both the digital and non-digital learning. The growth appears to be slightly larger for the digital group; however, the growth was not statistically significant. There is not a significant difference in the preassessment and eight-week postassessment score gains when using the digital word wall when compared to the scores of the students using the non-digital word wall.

Graph 3: Multiple-choice 8 Week Results



Vocabulary knowledge scale eight-week assessment results. Students were also assessed with the vocabulary knowledge scale at the eight-week mark to aid in determining if the digital word wall had an impact on remembering the learned vocabulary. In regards to the vocabulary knowledge scale, the mean for the words learned through the digital word wall was 37.47 and the mean for the non-digital word

wall was 35.63. From the pretest to the eight-week posttest, there was a mean gain of 17.03 points for the words that students learned with the digital word wall; the mean gain was 14.75 points for the words that the students learned with the non-digital word wall.

Table 8: Vocabulary Knowledge Scale 8 Week Descriptive Statistics

	Mean	Median	Mode	SD	Range
Digital Pretest	20.44	20	22	6.4	29
Digital 8-Week Posttest	37.47	40	45	7.6	36
Non-Digital Pretest	20.88	20	18	5.35	22
Non-Digital Posttest	35.63	37	45	7.83	27

Before running the ANOVA, the assumption for sphericity must be met. Mauchly's test of sphericity indicated that there were unequal variances ($p < .001$). As a result, a corrected measure of the ANOVA was again used; the researcher read the Greenhouse-Geisser correction. As aforementioned, there were three null hypotheses. The first null hypothesis is the main effect, time: pretest versus posttest are equal; i.e. there was not any growth of vocabulary skills from the preassessment to the postassessment. The main effect for the second factor, word wall: digital versus non-digital are equal; i.e. there was not any difference in the scores in regards to digital versus non-digital means of instruction. The third null hypothesis was that the two factors did not interact or that the difference between the groups at pretest was equal to the difference between the groups at posttest.

Table 9: ANOVA Summary Table for the 8 Week Vocabulary Knowledge Scale Assessment

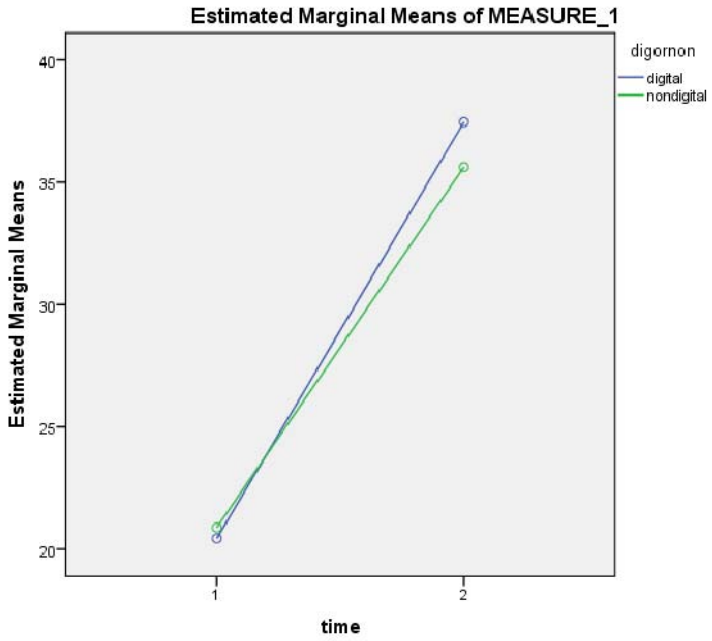
	df	SS	MS	*F*
Time (Pre and 8 wk Post)	1	10848.58	10848.58	422.75*
Error	84	2155.58	25.66	
Word Wall (digital or non)	1	20.93	20.93	.305
Error	84	5756.19	68.53	
Time x Word Wall	1	55.84	55.84	2.18

*$p < .01$.

The first null hypothesis was rejected. The vocabulary knowledge scale indicated that even at the eight-week mark, there was a significant main effect for time. F (1, 84) = 422.75, $p < .001$. This means that the vocabulary knowledge scale eight-week posttest scores were significantly greater than the vocabulary knowledge scale pretest scores. The partial eta squared was equal to .834; therefore, 83% of the variance of the scores can be explained by the time. The second null hypothesis was retained. The main effect for the second factor, word wall: digital versus non-digital was not significant, F (1, 84) = .305, p= .582. This means that there was not a significant difference between the groups. There was not a significant interaction effect, F (1, 84) = 2.18, p= .144. This means that there was not a statistical difference of retention of Greek and Latin roots as indicated by the preassessment and eight-week postassessment score gains of the students when using the digital word wall compared to the students when using the non-digital word wall.

The graph, on the following page, illustrates the vocabulary knowledge scale preassessment and eight-week postassessment growth for both the digital and non-digital word wall groups. The graph is indicative of the vocabulary growth experienced by both groups during the study. Specifically, the digital and non-digital groups significantly increased their vocabulary knowledge from pretest to eight-week posttest assessments. The digital pretest scores were lower than the non-digital pretest scores. However, the digital eight-week posttest scores were larger than the non-digital eight-week posttest scores. There was growth from pretest to eight-week posttest for both the digital and non-digital learning. The growth appeared to be slightly larger for the digital group. However, it is important to note that the growth of the digital word wall group as compared to the growth of the non-digital word wall group was not statistically significant. This data suggested that there was not a substantial difference in students' retention of vocabulary knowledge when they used the digital word wall as compared to when the students used the non-digital word wall.

Graph 4: Vocabulary Knowledge Scale 8- Week Results



Discussion. When looking at descriptive statistics, the means of the multiple-choice and vocabulary knowledge scale assessments indicated that there might be a difference in students' vocabulary retention when using the digital word wall versus the non-digital word wall. However, when the two-way Repeated Measures ANOVA was run; the only significant results were the pretest to eight-week posttest gains. Although the means for the digital words were higher than the non-digital for the multiple-choice and vocabulary knowledge scale assessments, they were not statistically significant. This indicates that the digital word wall does not enable students to retain knowledge of Greek and Latin roots any more effectively than the non-digital word wall.

Research Question Three: What are teachers' and students' perceptions of the digital word wall?

In order to best answer question three, this section has four parts. In the first part, each teacher interview is briefly discussed. Then, themes which emerged from the teachers' interviews are presented. Third, each student interview is briefly summarized. Finally, themes which emerged from the students' interviews are presented.

The Teachers. There were two teachers involved in the study. Each was interviewed; a synopsis of each interview is presented below. The teachers collectively have more than 30 years teaching experience. Ms. Lillian was Class A's teacher; she had been teaching for 12 years. Ms. Narris was Class B's teacher; she had been teaching for 20 years.

Ms. Lillian. Ms. Lillian was the teacher for Class A. For the first three weeks, her class had instruction through the digital word wall. For the second three weeks, her class experienced the non-digital word wall.

Ms. Lillian was a considerate and reflective teacher. She stated that her goals included being the best teacher that she could be, furthering her career, and raising thoughtful, giving children. She felt fairly comfortable with acquiring and dealing with new technologies. She had experience using technology in her classroom on a daily basis. Ms. Lillian had an interactive white board; most of her lessons were delivered through this medium. The students in her classroom used the computer to create PowerPoint presentations, typed essays, storyboards, Moviemaker videos, etc. Ms. Lillian had not previously had experience with a digital word wall. However, she was

willing to learn the technology necessary to be involved in this study. She made it clear that she believed students learned better with technological tools.

When asked, Ms. Lillian stated that she preferred the digital word wall method of instruction over the non-digital word wall method of instruction. Ms. Lillian felt as though the students were more engaged with what could be termed the digital method of instruction; she felt that students found higher quality words with the digital method. The *digital method*, as a term, was coined by the researcher to encompass not only the digital word wall but also the digital tools such as the online dictionaries, access to Google, access to unlimited images, etc. Ms. Lillian specifically mentioned that her students found "new and different words that were appropriate" when they had access to the aforementioned digital tools. Ms. Lillian declared that the traditional "dictionary really limited" students. This could be attributed to the fact that students were only able to find words that began with the Greek or Latin root in the traditional dictionary. For example, students were more apt to find *hydrate* than *dehydration* in the traditional dictionary because of the alphabetical organization of this type of dictionary. This restraint was removed when the students were given access to digital tools such as the aforementioned online dictionaries, access to Google, access to unlimited images, etc. Ms. Lillian noticed extreme repetition of words when students used the traditional dictionary. In fact, many groups would present the same or very similar words to the class. Ms. Lillian attributed this to the aforementioned layout of the dictionary and called the traditional dictionary a "limiting" factor of the non-digital word wall.

Ms. Lillian stated that her students were "more engaged" with the digital word wall. She discussed that her students were incredibly excited about sharing their digital

word wall work on the interactive white board, “They wanted to present. They wanted to put their digital word wall up on the Promethean (*interactive white board*) board and show their classmates what words they had found and the pictures and sentences to go with the words.” Ms. Lillian found that her students were excited about sharing their word walls and showing their classmates the new and interesting words that had been found with the digital tools.

According to Ms. Lillian, increased retention was an additional positive factor of the digital word wall. She stated, “I feel like they had an increased retention of the Greek and Latin roots.” Not only did Ms. Lillian feel like her students had increased retention when using the digital word wall over the non-digital word wall, she also felt that when her students had access to the digital word wall, they were better able to apply their knowledge of Greek and Latin roots in “all contexts of learning.”

Ms. Narris. Ms. Narris was the teacher for Class B. Her students were taught with the non-digital word wall for the first three weeks of the study and the digital word wall for the second three weeks of the study. She described herself as organized, a perfectionist, and the keeper of a “Type A personality.” Some goals that Ms. Narris had for herself were to continue learning about technology and to retire. Ms. Narris was not quite as comfortable with the technological aspect of the digital word wall. She stated that she was not “as familiar with how to open the new tabs and all that kind of thing.”

Ms. Narris felt that “when the computers cooperated” the students enjoyed learning through the digital word wall more than the non-digital word wall. However, the computer issues that Ms. Narris had to deal with were quite frustrating. There were problems with the digital word wall not saving properly. For example, a student might

attempt to copy and paste an image onto the digital word wall, the student might then save the picture, navigate away from the page, and upon returning determine that the picture did not save to the wall.

Although Ms. Narris and her class experienced difficulty with the technological aspect of the digital word wall, she still maintained that students were more responsive when computers and the Internet were involved. Ms. Narris said, “Yes, they’re definitely more engaged.” This led to an interesting conversation. Ms. Narris had been teaching for 20 years and discussed that when she began teaching, there was very little technology in the classroom. However, students were still involved in the classwork. When pressed to explain this anomaly, Ms. Narris mentioned that the students did not have much technology in the home or in their lives. It was not something that they were used to. Presently, students are growing up with technology and they expect to have technological tools and technologically savvy teachers. Ms. Narris stated that she believed technology to be more engaging and challenging for the students.

Ms. Narris liked both the digital and non-digital formats of the word wall better than anything the fifth grade teachers had done in the past for vocabulary instruction. She felt that during this study, students were making great connections and figuring out the meanings of words by using the Greek and Latin roots. Ms. Narris said that a key benefit of the non-digital word wall to be that it was always present in the room unlike the digital word wall which was only up when the students were on a computer.

Discussion. The two teachers discussed their preference for both the digital and non-digital word walls over the previous method of Greek and Latin root instruction. Ms. Lillian stated, “They retained the Latin roots much more so this year than they have

in years past." Ms. Narris said that she believed "they learned more from both of them, more than anything we've ever done before." Ms. Narris enjoyed that, with the word wall, the students were able to "manipulate the words themselves." During the interview, Ms. Narris described the previous form of Greek and Latin root instruction. The teachers would present the sole Greek or Latin root on Monday. The teacher would give the root, the meaning of the root, a word example, and a sentence with the root. For example, if the root was *hydro*, the teacher might say, "Your root this week is *hydro*. *Hydro* means water. To *dehydrate* means to take the water out of something. A sentence would be: Athletes know they are *dehydrated* when they get a headache or begin to get dizzy." For homework, students would be responsible for finding an additional word containing the Greek or Latin root and the meaning of that word. For example, the student might find the word *hydrophobia* and define it as *a fear of water*. Both teachers felt very strongly that the word wall was a better form of instruction than the method (explained above) that had been used for the last several years.

There were several themes which emerged from the data. The teacher findings fell primarily into two broad categories: (1) motivation to use technology for their students, and (2) motivation to use technology for themselves. The category of *motivation to use technology for their students* essentially encompasses the teachers' desire to utilize technology for the sake of their students. Both teachers noted several positive outcomes with their students when the technological tools, such as the digital word wall, digital dictionary, access to Google, access to countless images, etc., were available. The category of *motivation to use technology for themselves* includes the teachers' desire to use, or their levels of comfort using, technology for the sake of

themselves. The teachers differed in this category. One teacher felt at ease with and enjoyed personally using technology and the other teacher did not feel as comfortable and struggled with the technology on a personal level. While both teachers recognized the importance of including technology in the classroom for the sake of the students, they differed in their personal utilization of and level of comfort with technology.

Motivation to use technology for their students. When analyzing the data, the researcher noted that while one teacher felt comfortable using technology and the other did not, both teachers were interested in utilizing technology for the sake of their students. Both teachers felt that when their students had access to digital tools: (1) the students found a large variety of words, (2) the students seemed engaged, and (3) students appeared to enjoy what they were doing.

Both teachers noticed that students found more interesting and unique words with the digital tools. As was mentioned earlier, this could be due to the linear, alphabetical organization of a traditional dictionary. With the non-digital word wall, students were finding only the words that began with the Greek or Latin root. When students had access to the digital tools, they were able to find a myriad of words deriving from the Greek and Latin roots. For example, in both classes, to illustrate the Latin root *dict*, most groups found the words dictionary, dictation, and dictate. Those words begin with the Latin root word *dict* and were easy to find in a traditional dictionary as the words begin with the Latin root. When students had access to digital tools (such as the Internet, digital dictionaries, Greek and Latin root websites, etc.) they found a larger variety of words. Ms. Lillian stated, “I felt like they found more quality words.” She elaborated by saying, “I would see new and different words that were

appropriate." Ms. Narris stated that students, "were able to find some more unusual words and they really enjoyed that" with the aid of the "digital dictionary." Group one in Ms. Lillian's class found, defined, and illustrated the following words which contain the Latin root *dict*: predict, dictionary, dictation, contradict. An additional example is with the Latin root *port*. Most students found the words portable and porter. When given access to the digital tools, group five in Ms. Lillian's class found words such as export and transport. The third example is for the Latin root *spect*. Most students were easily able to find the words such as spectacle and spectator. When given digital tools, group three in Ms. Narris' class also found, defined, illustrated and presented the words circumspect and retrospective. Finding, defining, illustrating, and presenting a larger and more varied set of examples gives students more practice with these Greek and Latin roots. Researchers have found that increased exposures are necessary for students to learn the vocabulary (Dalton & Grisham, 2011; Graves, 2009).

The teachers involved in the study were adamant that students were more engaged when technology was involved. Ms. Lillian stated, "Students were more engaged." Students were particularly eager to share their learning on the interactive white boards. Ms. Lillian declared that students, "wanted to present. They wanted to put their digital word wall up on the Promethean board and show their classmates what words they found and the pictures and sentences to go with words." Students appeared to be excited to show off their digital word walls to their classmates. Commenting on technology in the classroom, Ms. Lillian said that students "automatically become 110% more engaged." Ms. Narris, in a separate interview, commented that the students were "definitely more engaged" when computers were involved. One of her students,

Keisha, discussed how she enjoyed being on computers because she was able to stay focused on the task at hand, “I can stay focused on the reading.” In a separate interview, Dori from Ms. Lillian’s class had a similar sentiment. Dori stated, “You get tuned out after a book. Like, after so many pages, you get tuned out.” She went on to describe how a computer allows the user to go through “different pages” and “different sites” while “learning something new”

Third, the teachers noted that students seemed to enjoy the digital word wall more. Ms. Narris said, “When the computers cooperated, they enjoyed the digital way more.” Stephen, in Ms. Narris’ class, enjoys using computers. Implying that learning was fun when digital tools (such as the computer, Internet, and websites) are involved, he said, “You have opportunities and sometimes you find new sites and even though they’re learning sites, it turns out to be pretty fun.” When asked about the teachers’ plans for next year in regards to the digital versus non-digital word wall, Stephen said that the best approach would be, “a little less of the board and a little more of the computer!” The teachers projected that this could be due to the digital aspect of the digital word wall aligning with the digital nature of the students’ lives.

Motivation to use technology for themselves. While both teachers felt a drive to deliver instruction in tandem with technology for the sake of their students, their personal sentiments differed when it came to feeling comfortable with the technological aspects of instruction. Both teachers expressed a motivation to learn technology and keep up with the newest forms of instruction. Ms. Lillian discussed her desire to use and learn with technology on a personal level. When talking about the students learning

with technology, especially digital tools, Ms. Lillian said, “I, myself, like to learn like that.”

However, it should be noted that Ms. Narris felt a bit uncomfortable with the digital word wall. Although she discussed one of her goals as, “to continue learning, especially about technology,” she found the digital word wall to be more complicated to use. Ms. Narris had some “computer issues” that were frustrating. Some of her students were having trouble saving the images to their digital word walls. There were also a few instances of students being unable to log in; I, the researcher, was present for one such issue. I was able to type the password in for the student and get him logged in; he was typing an incorrect password. Ms. Narris discussed how she was “not as familiar” with digital tools. For example, she mentioned how she was “not as familiar with how to open all the new tabs and all that kind of thing.” She went on to say that she’s not as familiar with “computers.” Although this was new territory for Ms. Narris, she did not give up. While she did not feel incredibly comfortable with technology, she stuck with instruction on the digital word wall because she felt the importance of providing her students with access to digital tools.

The students. Six students (all names are pseudonyms) were interviewed in order to determine their perceptions of the digital word wall. In order to get multiple viewpoints, the researcher interviewed one low, one medial, and one high student from each class. The students from Class A (in order from low score to high score) were: Dori, Michael, and Jaymie. These students had access to the digital word wall for weeks one through three and the non-digital word wall for weeks four through six. The students from Class B (also in order from low score to high score) were: Tyshaun,

Keisha, and Stephen. These students had access to the non-digital word wall for weeks one through three and the digital word wall for weeks four through six.

Dori. Dori was a sweet, friendly student whose favorite subject was social studies because she loved to learn about people. She always had a smile on her face. Dori is a Black female. Her career goals were to become a teacher or a hair stylist.

Dori felt that the digital word wall provided a sense of ease. She said that you could just look at one screen instead of having to flip though the many pages of a dictionary in search of the perfect word. She also stated that she preferred the digital word wall (Dori used the phrase “the one of the computer”) because “you could find more information.” When asked how she preferred to look up meanings of words, Dori responded that she preferred the computer for several reasons. First of all, some dictionaries are for “kids,” some are for “adults,” and some “don’t have the words you’re looking for.” Nagy (1988) found traditional dictionary definitions to be deficient as well; definitions can be complicated, they can be poor definitions, or they can lack the information needed for students to be able to use the vocabulary word correctly. Dori felt like she was able to get more information on individual words when she was able to use the digital tools.

At home, Dori used the computer in order to practice for the MAP test. The MAP test is a computer based assessment that the school district gives twice a year. She also used the computer to play games as well as to frequent Facebook. Dori loved that on a computer she could go to different pages and different sites. She also pointed out that if she was learning something new, an Internet site was most likely to give her the

clear, concise directions that she needed. She preferred the computer to reading a book because of the aforementioned directions which help her learn.

Dori loved that she was learning new words. She especially enjoyed that if she forgot what one was, she could easily look it up again. She said that looking the word up again helped it get "stuck" in her head. She felt that she was going to be well prepared for middle school with the knowledge of these Greek and Latin root words.

Michael. Michael's interview was very ephemeral. His answers were brief – often just a single word. It was difficult to get information from him. Michael is a White male and acted as though he were the class clown of the group.

Michael stated that he preferred the "digital" word wall. When asked why he preferred the digital, he responded that he liked the digital word wall better because it "was shorter." When pressed as to what he meant by "shorter," he responded that the digital word wall "did not take as much time" as the non-digital word wall. Michael said that he particularly enjoyed using a computer at home. When asked how he used the computer at home, Michael responded, "games." Michael mentioned his interest in freedom with regard to utilizing the computer at home. He had the ability as well as the freedom to get on whatever sites he wanted to frequent. His exact words were, "Free, you're like when you're at home you can get on whatever sites you want to." Although he did not have those same freedoms at school, he still enjoyed using the computer in the classroom. He stated that he would rather complete activities on the computer as opposed to the more traditional task of "reading something in class."

When asked what the best part of learning Greek and Latin roots was, Michael responded, "drawing." When Michael drew pictures, during the non-digital word wall

instruction, he felt it helped him to remember both the words and the meanings. This fits with what we know about vocabulary acquisition. Mountain (2002) found that students are more likely to learn vocabulary if they are personally engaged and actively participating in the lesson. Guthrie, Wigfield, Humenick, Perencevich, Taboada, and Barbosa (2006) found that hands-on work with vocabulary words is vital for vocabulary acquisition. Michael found himself very engaged in the vocabulary lessons when he was allowed to create visual illustrations with the Greek and Latin roots.

Jaymie. Jaymie is a Black female and was fairly quiet in class. She described herself as being, "helpful, nice, and grateful." Jaymie had many goals for herself; they included getting good grades and not getting in trouble too much. She said that she would like to become a teacher when she is older.

Jaymie liked learning with the digital word wall better. She thought that the digitization of the word wall made it faster to use and made it easier for students to get started. Using the digital word wall meant not having to wait for materials to be passed out (such as Frayer Models, markers, and dictionaries) and being able to immediately get started. Research, Jaymie insisted, was also easier to conduct online. The computer allowed for infinite amounts of information to be placed directly at her fingertips.

Jaymie enjoyed the digital word wall because of the ease and because of how quick it was to get started. She could just "get up and go." She also enjoyed that the digital word wall seemed faster. This presents a bit of a conundrum with what we know about vocabulary acquisition. Nagy (1988) finds that more time spent on vocabulary tasks most often equates with more vocabulary knowledge and understanding. However, Jaymie's scores indicate that she actually did better with the digital word wall

tools (even though she felt the digital method to be the faster method of instruction). Of the four measures, Jaymie scored higher on the words in which she studied with the digital word wall on three of the four. She demonstrated equal learning on one of the four measures. It is important to note that the time spent on instruction, as was discussed in the previous paragraph, was on the perception of Jaymie. When I asked Jaymie's teacher if they spent much less time on the digital word wall, she said she felt that her class spent equal time in the computer lab working on the digital word wall and in the classroom working on the non-digital word wall. I did not have teachers time their lessons and it is beyond the scope of this study to investigate this further but it is an interesting topic for future investigations.

According to Jaymie, learning words during the study had been "fun." She enjoyed the root words because she could, "get one root and make many more words!"

Tyshaun. Tyshaun was an incredibly sweet fifth grader whom everyone seemed to adore. He appeared to easily make friends wherever he went. The other students tended to naturally gravitate toward Tyshaun; he was well liked by students and teachers alike. Tyshaun is a Black male. One of the goals that he had for himself was to get better grades.

Tyshaun enjoyed using the computer at home to play "games." He specifically mentioned that he particularly enjoyed "animal games." Tyshaun said that he typically used the computer at school for typing "essays" and playing learning games on sites such as www.coolmathforkids.com. He really enjoyed learning the new root words and getting to "see" the words. He stated that he felt like he learned much more with the word wall than with the fifth grade's district mandated word instruction, "word study."

Word study focused mainly on spelling patterns and Tyshaun enjoyed being able to learn the meanings of new words.

Tyshaun was the sole student who said that he preferred the non-digital word wall. A possible explanation for this, outlined below, is based on an observation I conducted when performing an implementation fidelity check. Once a week, implementation fidelity checks were completed. I went into each classroom with a checklist of crucial aspects of the digital and non-digital word walls. It was noted, that during an implementation fidelity check, Tyshaun was finishing an essay assignment instead of working on the digital word wall. The researcher asked Ms. Narris, Tyshaun's teacher about the reasons behind this. Ms. Narris explained that Tyshaun had not finished his "Superintendent's Essay" (a district-wide assignment) and he was told to complete it during their work in the computer lab. The fact that Tyshaun was made to make up his late work during his digital word wall instructional time may have contributed to his preference for the non-digital word wall. Additional possibilities for Tyshaun's preference include that he might enjoy writing things down as opposed to typing them. He may, like Michael, enjoy the artistic aspect of the non-digital word wall. Although he did prefer the non-digital instruction more than the digital instruction, Tyshaun performed better on the words he learned with the digital word wall on three of the four measures.

Keisha. Keisha was an incredibly social student who had created her own step-team on the playground. She had her steppers practice every day. A natural-born leader, Keisha taught a group of eight young ladies how to step during recess. They put on

shows for the other students as well as for the teachers about once a week. Keisha is a Black female.

Keisha felt that the digital word wall was “easier” and faster to use. She specifically mentioned that the digital word wall was “quicker to do things on.” Keisha said that she enjoyed doing schoolwork on the computer because it allowed her to focus more on the task at hand. She felt better able to drown out distractions when working on the computer rather than working at her seat. Keisha also said that one thing she really liked about computers was that you could keep trying until you got it right, “If I don’t win, I can just replay by myself.” She also discussed her propensity to get on the computer because of the lack of distractions when compared to a traditional lesson in a typical classroom, “It would be more easier to read because I can stay focused on the reading and there usually be other distractions in class.”

Keisha did state that she felt like she learned more with the non-digital word wall, “I think I learned more with the paper because I could look up the words and try to figure out the definitions;” this, however, was not confirmed with data. In actuality, Keisha scored higher on the words that she learned with the digital word wall on four of four measures.

Stephen. Stephen was creative and extremely interested in math and science. About halfway through the study, one day I watched him construct a solar powered car (from a kit) during recess. Stephen is a White male and was in the gifted and talented program at the school. Stephen emphatically stated that he enjoyed the digital word wall more than the non-digital word wall. He liked that they were able to work more “independently.” He said that “it was easier to find definitions on the computer” and it

was also easier to find the" pictures" online than it was to find the definitions in a traditional dictionary and create his own pictures. He felt like he could remember information off of the digital word wall better than the non-digital word wall. This assertion was not supported with data; Stephen performed equally on the measures. He scored higher on the words he learned with the digital tools on two of the four measures. When asked why he felt that he could remember the vocabulary better when using the digital word wall, he responded, "it's easier to remember things that have more color."

Stephen said that he enjoys playing computer games during his free time. For Stephen, a perk of using the computer, over a more traditional activity, is that one can multitask. He said, "You can do a lot." He also mentioned that he enjoyed that he could "open new tabs and do more than one thing at a time." He appreciated having several pages up at once. Stephen said that using the computer at school was fun because, "You have more opportunities and sometimes you find new sites and even though they're learning sites, it turns out to be pretty fun."

One of the problems that his class experienced with the digital word wall was "saving problems." Stephen said that some of the pictures would not stay on the website. He suggested that for the future, the digital word wall could be set up to have a pre-chosen (by the teacher) set of pictures that the students could select from.

When asked what his favorite part of learning Greek and Latin roots was, Stephen responded, "Well, it's like roots I've never heard of and I put them or find them in new words. It's like words I can use in my everyday life."

Discussion. Five of the six interviewed students stated that they preferred learning vocabulary through the digital word wall. The feedback was not entirely positive, however. Several students mentioned word wall issues. The students discussed problems that they encountered with both the digital and non-digital word walls. One of the students mentioned an issue with saving the pictures on the digital word wall. He stated that sometimes the pictures, or images, would not "stay on" the website. He did suggest that the teachers should post a list of acceptable images for the students to choose from. A different student discussed locating a Greek or Latin root and its meaning. She specifically mentioned that sometimes it might be the wrong meaning to "what you thought it was." There was only one issue that any of the students brought up about the non-digital word wall. One of the students said that it just took too long. She specifically stated, "It takes a lot of time to do the ones on the paper."

There were several themes that emerged from the data: (1) students found the digital word wall to be a faster method of learning, (2) students thought that it was easier to learn with the digital word wall, and (3) students felt that the computer was a motivating tool.

Faster. Half of the students interviewed, three out of six, discussed that they thought the digital word wall was a faster method of learning. While discussing the time involved with the non-digital word wall, Jaymie mentioned, "It takes a long time to do the ones on paper." However, she enjoyed that with the digital word wall, "you just click on a button, you can just start typing, and it's up. Then you gotta get your root and go!" When discussing the digital word wall, Michael mentioned, "It was shorter." When questioned about the meaning of "shorter," he elaborated to say that the digital

word wall did not take as much time as the non-digital word wall. Keisha stated that she preferred the digital word wall because it was, “quicker to do things on.”

The question is: does faster mean better? The answer is multifaceted. While the answer is beyond the scope of this paper, it is definitely important to consider. Essentially, faster does not necessarily mean better learning outcomes. The word “faster” does not appear on any chart or in any book for Bloom’s taxonomy. Important to note, especially in this study, is that “faster” was a theme among student interviews. The digital word wall being the “faster” method of instruction was a student perception. This could mean that students were more engaged in the digital word wall and therefore the time went by more quickly. On the other hand, it could mean students were less engaged and merely skimmed through the lesson.

One positive outcome that may exist with the students viewing the digital word wall as faster is that many teachers do not teach vocabulary every day, citing lack of time. Perhaps this perception that this digital method of instruction takes less time than the more traditional method of vocabulary instruction could be a good thing if it were to encourage teachers to provide specific, focused vocabulary instruction on a daily basis.

On the other hand, the students’ perception of the digital word wall being faster was different than the perception of the teachers. One teacher said that the digital word wall instruction actually took longer than the non-digital word wall instruction. Ms. Narris stated, “The digital word wall definitely took more time whereas the word wall on the wall was not as time consuming.” Ms. Lillian believed both methods of instruction to take similar amounts of instructional time.

Easier. It is interesting to note that three students believed the digital word wall to be the easier method, when compared to the non-digital word wall, to learn Greek and Latin roots. Of course the term "easier" means different things to different people. The word *easie*r certainly had varied meanings for the students who were interviewed in this study. Some students discussed that the digital word wall was easier in the regard of the infinite access to information: it was simply easier to locate information with the digital word wall than it was with the traditional tools such as the dictionary. A few discussed that the digital word wall made it easy to view multiple sources of information at once; tabs could be utilized and there could be several things going on at once (a Google Image search, determining the etymology of one of the Greek or Latin roots, etc.) Finally, a few students mentioned that it was easier to stay focused with the digital word wall.

Students were asked which method (digital or non-digital) they preferred. However, they were not directly asked if they thought that one was easier than the other. Consequently, these students mentioned that they thought the digital word wall was the easier method of instruction with no prompting. Stephen, a student in Ms. Narris' class stated, "It was easier to find definitions on the computer and pictures." Stephen also detailed that one just had to type in a word and there was infinite information that was then at one's fingertips. He also discussed that he found it easier to remember information from the digital word wall. Specifically, Stephen mentioned the colors and size of the objects on screen. With the computers, the students had the ability to change the size of the fonts, the colors of the fonts, and the pictures. This manipulation allowed for students to become more engaged with the vocabulary

learning. Several researchers (Mountain, 2002; Wells & Narkon, 2011) have found that when students are actively involved with the words, their learning increases.

Some of the students preferred having all of their word wall materials on one page. The non-digital word wall required students to have three Frayer model sheets of paper, pencils, colored pencils, and dictionaries. The digital word wall could be completed with just one screen at the computer. Dori, a student in Ms. Lillian's class, stated that "everything can be on one page." To this student's detriment, with a traditional book she had to keep "flipping through the pages." Stephen, a student in Ms. Narris' class, had a similar sentiment. He discussed his appreciation for being able to manipulate a considerable amount of information on one screen, "You have all these things on one little screen and you can do a lot of them and open new tabs to do more than one at a time."

Keisha, a student in Ms. Narris' class, mentioned the ease of staying focused on the computer. She discussed the difficulty of concentrating in class and stated that she found it "easier to read because I can stay focused on the reading and there usually be other distractions in class." Keisha went on to affirm that she finds it easier to stay focused on the computer than when she is in a traditional lesson in a classroom.

Motivational. An analysis of the interviews suggested that students found the computer and/or digital word wall to be motivational. Students found the computer to be fun and forgiving. Students found the computer forgiving in the sense that they could retry as many times as they needed in order to correctly complete a game or a task. The students also discussed their propensity to multitask; the computer allows them to do that with ease.

Five of the six students mentioned that they enjoyed playing games on the computer. This indicated that students viewed the computer as more of a tool for fun than a learning tool. Stephen stated, “You have more opportunities and sometimes you find new sites and even though they’re learning sites, it turns out to be pretty fun.” This seems to suggest that students are naturally predisposed to believing that projects on the computer are going to be “fun,” at least to some degree. Unfortunately, although students found using the computer to be an enjoyable experience, there was no data to suggest they spent increased time on the digital word wall. No students reported working on the digital word wall on their own time.

Several students alluded to the infinite opportunities that they had access to on the computer. Keisha mentioned that in games if she didn’t win, she could just “replay” by herself. Michael mentioned that he was free on the computer. He could “get on whatever sites” he wanted to. Student choice is vital in education (Guthrie, et al., 2006). Allowing students to choose their activities online, or in the case of the digital word wall, choose the root that they want to work on, the picture that would represent the word, and the sentence to accompany the picture most likely led to greater student achievement (Guthrie, et al., 2006).

In this day and age, students apparently like to multitask. The digital tools in this study allowed students to do just that. Students were able to work on different parts of the assignment. Within a short time frame, students were able to work on aspects of the digital word wall such as (1) finding words which contained the Greek or Latin root, (2) finding illustrations to represent the chosen word, (3) defining that word, (4) writing sentences to illustrate that word, and (5) displaying their knowledge on the digital word

wall. Stephen discussed how he enjoyed having all these programs on the screen at the same time. He enjoyed that he had one little screen with as many tabs as he wanted. He loved to "do more than one at a time."

Summary

The findings were reported in three sections which aligned with the three research questions that were posed. The first section addressed the research question: *What effect does the use of a digital word wall have on students' vocabulary acquisition when compared to the use of a non-digital word wall?* The findings seemed to indicate that the digital word wall may in fact have helped the students in this study learn the Greek and Latin roots with a deeper level of understanding than the non-digital word wall. There was no statistical difference in the scores of the digital word wall words and the non-digital word wall words with the multiple-choice test. There was a statistically significant difference in the digital and non-digital word wall words when measured with the vocabulary knowledge scale assessment. This difference could be explained by the different levels of understanding required on each measurement. The multiple-choice assessment positioned students on the first level of Bloom's taxonomy, *remembering*; students were not asked to extend their knowledge on this measure. The students were asked to select the meaning which most closely resembled the meaning of the Greek or Latin root; this act of recall is indicative of the remembering level on Bloom's taxonomy (Anderson, et al., 2001). The vocabulary knowledge scale assessment situated students on the second level of Bloom's taxonomy, *understanding*. Therefore, simple recall, as measured by the multiple-choice assessment, there does not appear to be a difference in the digital versus non-digital methods of instruction.

However, when the deeper level of understanding was measured, as evidenced by the vocabulary knowledge scale assessment scores, the digital word wall was superior to the non-digital word wall.

This finding matches what Cisco Systems (2006) documented which was that research indicates that technology does have the ability to increase learning rates. However, Cisco (2006) found that this gold mine remains largely untapped due to lack of teacher training, expense of software, and lack of documentation on student outcomes. The digital word wall was free to the school and teacher training was minimal as well as free. These factors make the digital word wall a viable instructional method which can be easily implemented in most classrooms.

The second section addressed the research question: *To what extent do students retain knowledge of the vocabulary words when using the digital word wall when compared to the non-digital word wall?* The results were not statistically significant which indicates that the digital word did not aid students in retaining knowledge of the Greek and Latin roots any more than the non-digital word wall did.

The third section addressed the research question: *What are the teachers' and students' perceptions of the digital word wall?* The first part of the section detailed the teachers' perceptions of the digital word wall. Both teachers felt it was important to utilize technology in the classroom. However, one of the teachers felt more comfortable than the other using technology. The second part dealt with the students' perceptions of the digital word wall. Much like their teachers, the students also had varied opinions. Overall, students felt that the digital word wall was faster, easier, and more motivating. The students' insights about the digital word wall were of a personal nature i.e. some

students preferred the digital word wall as they thought it was more motivating. However, some students favored aspects of the non-digital word wall. Personal preference played a role in the wall that students felt more comfortable using.

No matter the preference, the digital word wall did meet the classifications deemed necessary for quality vocabulary instruction by Nagy (1988). Nagy (1988) found that vocabulary instruction should include integration, repetition, and meaningful use. According to Nagy (1988), integration entails tying new learning to familiar concepts; semantic mapping is essential. Students may have felt that the digital word wall was easier due to the integration that was taking place. In fact, students were required to connect their learning of these new Greek and Latin root words with previous knowledge. The repetition, which entailed providing students with many encounters in order for the knowledge to move into their reading vocabulary, was present with the word wall. Students were required to work on the same three Greek and Latin roots for the duration of a week. Third, students need the opportunity to see the meaningfulness of their work. There should be context in vocabulary instruction (Nagy, 1988). Students were using the Greek and Latin roots in ways that they deemed important. The context was created for the students by the teacher as well as by the students themselves as they created their own word walls. Being responsible for creating their own word walls may have contributed to students believing the digital word wall to be more motivating.

Stephen, one of the students in Ms. Narris' class hit the proverbial nail on the head when he said that he enjoyed the digital word wall "because it seemed a lot easier and I am more of a computer person." The digital word wall may not be *the* answer to

vocabulary instruction but it is an additional tool that teachers might use in order to increase students' vocabulary acquisition, retention, and motivation. The digital word wall is not the best method of instruction for every student. However, it might just be the tool needed to get some students excited about vocabulary instruction. Vocabulary instruction should include active participation (Mountain, 2002; Wells & Narkon, 2011) and personal engagement (Mountain, 2002). Both the digital and non-digital word walls inspired active participation from the students. Personal engagement is a different discussion. Some of the students were more engaged with the non-digital word wall (i.e. Michael enjoyed drawing the pictures in the non-digital word wall instruction), and some of the students felt more engaged with the digital word wall. As Stephen, the self-described "computer person," alluded to, everyone learns in different ways. Those students who enjoy utilizing technological tools may prefer learning vocabulary with the digital word wall instructional method as opposed to the non-digital word wall instructional method.

CHAPTER 5: CONCLUSION

A decade ago, Beck, McKeown, and Kucan (2002) wrote "It is clear that a large and rich vocabulary is the hallmark of an educated individual. Indeed, a large vocabulary repertoire facilitates becoming an educated person to the extent that vocabulary knowledge is strongly related to reading proficiency in particular and school achievement in general" (p. 1). As Beck et al. (2002) remind researchers and teachers alike, a robust vocabulary is essential to students' school careers and is also a central component in students' success outside of school. This can be attributed to the fact that vocabulary is closely aligned with students' reading comprehension (Anderson & Freebody, 1981; Anderson & Freebody, 1985; Beck, McKeown, & Kucan, 2002; Graves, 2004; NICHD, 2000; RAND Reading Study Group, 2002; Snow, Burns, & Griffin, 1998). Although many researchers and teachers (Allen, 1999; Beck et al., 2002; Green, 2003; Wood, Harmon, & Taylor, 2011) agree that teaching vocabulary is important, the best methods with which to educate our children are not as unambiguous. This underlies the purpose of the study, which was to examine the effects of a digital word wall on the vocabulary acquisition, retention, and motivation of fifth grade students. Specifically, the intention was to improve the vocabularies of students as well as to provide teachers with additional instructional tools.

In chapter four, the researcher presented the findings of this study which addressed the following research questions: (1) What effect does the use of a digital

word wall have on students' vocabulary acquisition when compared to the use of a non-digital word wall? (2) To what extent do students retain knowledge of the vocabulary words when using the digital word wall when compared to the non-digital word wall? and (3) What are teachers' and students' perceptions of the digital word wall? Specifically, to what degree is the digital word wall considered an engaging, motivating tool for acquiring and retaining vocabulary?

The study was conducted in four phases. In phase one of the study, the researcher trained the two participating teachers on both the non-digital and digital word walls to ensure consistency of instruction between methods and classrooms. In phases two and three of the study, the students studied three Greek and Latin roots per week for the duration of six weeks. In phase four, the researcher conducted interviews with six of the participating students and both of the participating teachers. In this chapter, the researcher first reviews the findings. Then the following are discussed: (1) the conclusions, (2) the implications of the findings, (3) the limitations of this study, and (4) suggestions for future research.

The Findings

The study took place during the spring semester of 2012. Two intact classes of 43 students and two teachers participated in the eight-week study. After teachers were trained, students took two preassessments: the vocabulary knowledge scale assessment and the multiple-choice assessment. Following administration of the preassessments, teachers began with instruction. Class A had access to a digital word wall that was used to learn three Greek and Latin roots (as well as a myriad of words containing those Greek and Latin roots) per week for a period of three weeks. Class B utilized a non-

digital word wall in order to learn the same three Greek and Latin roots for the same duration of time. At the three week mark, the students took two assessments to test for vocabulary acquisition. The classes then switched instructional methods. Therefore, students in Class A had the non-digital word wall as their instructional method, and students in Class B had the digital word wall as their instructional method. For the second time, students learned three Greek and Latin roots per week for three weeks. Assessments were again given to the students to test for vocabulary acquisition. After two weeks elapsed, students were assessed once more to test for retention of the Greek and Latin root meanings. Students and teachers were interviewed in order to determine the degree of motivation and engagement the digital word wall provided. There were three research questions that provided the direction for the study.

Research Question One: What effect does the use of a digital word wall have on students' vocabulary acquisition when compared to the use of a non-digital word wall? There were two findings in direct relation to the first research question: (1) the digital word wall did not appear to have an effect on simple recall of Greek and Latin roots when compared to the non-digital word wall. The results of the multiple-choice assessment were not statistically significant; and (2) the digital word wall appeared to be more effective for students' acquisition of Greek and Latin roots when higher levels of thinking were considered. Students performed significantly better on the vocabulary knowledge scale assessment on the digital word wall portion than they did on the non-digital word wall portion.

The descriptive statistics indicated that the digital word wall was more effective than the non-digital word wall for acquiring knowledge of the Greek and Latin roots.

The means for both assessments, the multiple-choice and the vocabulary knowledge scale, were larger at the six week mark for the words the students learned with the digital word wall. After analyzing the descriptive statistics, the researcher ran the Two-Way Repeated Measures ANOVA. The results of the ANOVA revealed that the interaction effect for the multiple-choice assessment was not statistically significant. These results suggested that the digital word wall did not affect simple recall of the Greek and Latin roots. Statistical results indicated that students achieved similar growth when instructed through the digital word wall as when instructed through the non-digital word wall.

The results of the vocabulary knowledge scale assessment did show that there was a statistically significant difference in the vocabulary acquisition of students when using the digital word wall as compared to the non-digital word wall. As was posited in chapter four, the difference in results could be explained by the dissimilar depths of knowledge required to answer the multiple-choice questions and the vocabulary knowledge scale questions.

When analyzing the difference in the digital versus non-digital methods of instruction, two findings are presented. First, there does not appear to be a difference in students' simple recall of Greek and Latin root meanings in the digital versus non-digital methods of instruction. This is demonstrated with the statistical results of the multiple-choice assessment. Second, the results suggest that there is a difference in student learning with the digital versus non-digital methods of instruction when higher levels of thinking are considered. This is indicated by the statistical results of the vocabulary knowledge scale assessment.

Research Question Two: To what extent do students retain knowledge of the vocabulary words when using the digital word wall when compared to the non-digital word wall? In regards to retention of Greek and Latin root meanings, the results indicate that the digital word wall was no more effective than the non-digital word wall as an instructional tool. After a period of two weeks, students' retention of the Greek and Latin root meanings was measured with both the multiple-choice assessment and the vocabulary knowledge scale assessment.

An analysis of the descriptive statistics revealed that the means of the multiple-choice and vocabulary knowledge scale assessments were different. This indicated that the digital word wall might positively impact students' retention of Greek and Latin root meanings. In fact, the means for both the multiple-choice assessment and the vocabulary knowledge scale assessment were larger for the roots learned through the digital word wall. However, when the two-way Repeated Measures ANOVA was run, the only significant results were the pretest to eight-week posttest gains. Although the multiple-choice and vocabulary knowledge scale assessment means for the roots learned with the digital word wall were higher than those learned with the non-digital word wall, the difference was not statistically significant. This indicates that the digital word wall does not enable students to retain the knowledge of Greek and Latin roots any more effectively than the non-digital word wall.

Research Question Three: What are teachers' and students' perceptions of the digital word wall? Specifically, to what degree is the digital word wall considered an engaging, motivating tool for acquiring and retaining vocabulary? There are two sets of findings that address research question three. First, the teachers' perceptions of the

digital word wall are presented. Second, the students' perceptions are presented. The findings which are related to teachers' perceptions are twofold. First, the level of comfort the teacher felt about technology impacted her comfort about the digital word wall. Second, regardless of personal comfort, both teachers felt that the digital word wall was a worthy instructional tool. The teachers believed the digital word wall to be effective as an instructional tool because they believed the technology was engaging for the students. There are also two findings related to students' perceptions of the digital word wall. First, most students found the digital word wall to be a faster, easier, and more motivating method of instruction. Second, students' preferences for aspects of the digital or non-digital word wall were not exclusive. In actuality, several of the students preferred varied features of the digital or non-digital word wall based on personal preferences.

There were two teachers who participated in the study. The teacher for Class A was Ms. Lillian. For weeks one through three, Ms. Lillian instructed her students in Greek and Latin root meanings through the use of the digital word wall. Ms. Lillian stated that she felt comfortable with using new technology and acquiring the skills needed to utilize that new technology. For weeks four through six, Ms. Lillian taught with the non-digital word wall. The teacher for class B was Ms. Narris. For the duration of weeks one through three, Ms. Narris instructed her students with the non-digital word wall. For weeks four through six, she used the digital word wall. Ms. Narris stated that she did not feel quite as comfortable with the technology as Ms. Lillian did. Ms. Narris had more technological issues with the digital word wall. Although the level of comfort between technology and the individual teachers varied, both teachers believed the

digital word wall to be a valuable instructional tool. Ms. Narris had technological issues such as opening the different “tabs” on the digital word wall’s pages. However, she still felt as though students were more responsive when they were learning with the digital word wall. She attributed this increased engagement to the technological aspects of the digital word wall.

As detailed in chapter four, students felt the digital word wall to be the faster, easier, and more motivating method of instruction when compared to the non-digital word wall. Student learning was more evident with the digital word wall. As measured by the vocabulary knowledge scale assessment, students’ scores on the Greek and Latin roots learned through the digital word wall were significantly higher than the scores for the roots which were learned through the non-digital word wall.

However, it is important to note that not every student preferred all aspects of the digital word wall. Students’ interests and preferences varied. Heilman, Collins-Thompson, Callan, Eskenazi, Juffs, and Wilson (2010) found that interest can influence the motivation of students. Which word wall, or even which facets of the word wall, students enjoyed most was dependent upon their personal preferences. For example, Michael said that he preferred the digital word wall over the non-digital word wall, but he mentioned his enjoyment of hand-drawing the illustrations. Michael particularly enjoyed drawing the pictures himself during the non-digital word wall instruction. He did not favor copying and pasting pictures that he found on the Internet as was required for the digital word wall. On the other hand, Dori, a student whose frustration with trying to find Greek and Latin roots in a traditional dictionary could be attributed to her struggle with spelling and sound-letter relationships, enjoyed the online dictionary

aspect of the digital word wall. Dori simply had to type the word into the text bar and the definition was presented. Personalization to match student interest can, in fact, lead to improved learning (Heilman, Collins-Thompson, Callan, Eskenazi, Juffs, & Wilson, 2010).

Students and teachers have varied tastes, likes, and dislikes. In an interview about online learning, Dede stated, "Too often the mind-set in education… is that there is one best way to do this" (Crow, 2010, p.10). Dede went on to discuss the need for "different types of learning that match different people's needs and preferences" (Crow, 2010, p. 10). While the digital word wall may not be the preferred form instruction for each student and teacher, it is an additional tool that teachers can utilize. Teachers can use the digital word wall as a supplementary method of instruction that allows students to have additional options to learning vocabulary. In fact, instruction can now be geared to student interest. Moreover, tailoring instruction to meet student interest could influence motivation of students to learn vocabulary thereby increasing vocabulary acquisition (Heilman et al., 2010).

Conclusions

Several conclusions can be garnered from this study that could impact students' vocabulary acquisition, retention, and motivation. First, the results suggest that both the digital and non-digital word walls are useful as tools to deliver vocabulary instruction. Also, the results imply that incorporating explicit vocabulary instruction into the daily classroom activity is an effective way to increase students' Greek and Latin root knowledge. Additionally, the results indicate that collaboration among students is also

important. Last, the results suggest that integrating technology with vocabulary instruction increases the motivation and engagement of most students.

Word walls. The results indicate that the word wall, as a method of instruction, seemed to be a viable way to teach Greek and Latin roots. This is important as quality instruction on Greek and Latin roots can enable students to determine the meanings of countless words (Rasinski et al., 2011). Consequently, this can have a substantial impact on students' vocabularies (Rasinski et al., 2011). Both the vocabulary knowledge scale assessment and the multiple-choice assessment posttest scores were significantly higher than the respective pretest scores for both acquisition as well as retention of the Greek and Latin roots. Not only did the scores on the assessment measures indicate the effectiveness of the word wall, the data from the interviews did as well.

Tyshaun, a student from Class B, discussed how he enjoyed both the digital and non-digital word walls. He stated that the word walls were better than the way his class had been learning vocabulary previously. Moreover, he thought that the best thing about participating in the study was "seeing and learning new words." Tyshaun's teacher, Ms. Narris, mirrored his sentiments. When asked if she thought she would use a digital or non-digital word wall as a way to deliver vocabulary instruction in the following year, Ms. Narris stated that she thought she would "definitely do one of those over what we used to do." Ms. Narris was referencing her preference for the word walls over the vocabulary instruction her grade level had engaged in for the past few years. Ms. Narris went on to say, "I think they learned more from both of them, more than anything we've ever done before."

In their study of word walls and reading fluency, Jasmine and Schiesl (2009) found that word walls should be used within the context of daily instruction. Moreover, they discussed the ineffectiveness of a word wall when it was merely placed on a wall (Jasmine & Schiesl, 2009). In the researcher's study, the digital and non-digital word walls had both explicit instruction of the Greek and Latin roots and repetitive work in meaningful context embedded within the lessons. Targeted instruction can be incredibly powerful and there have been several researchers who have conducted studies in order to find the best ways to purposefully teach vocabulary in the classroom (Coyne, Simmons, Kame'enui, & Stoolmiller, 2004; Nagy, 1988; Taylor et al, 2009). Furthermore, repetitious work in meaningful contexts is also vital to vocabulary learning (Allen, 1999; Baker, Simmons, and Kameenui,1995; Nagy, 1988). In addition, Baker, Simmons, and Kameenui (1995) proclaim the importance of meaningful, frequent use of the words students are attempting to learn. Students should also have the opportunity to frequently engage in word learning (Allen, 1999; Baker et al., 1995; Nagy, 1988). The word wall allows for this targeted, frequent, engaging instruction of vocabulary in the classroom (Green, 2003; Harmon et al, 2009). The data from this study supports the previous researchers' findings. Both word walls were discussed by students and teachers as being engaging and instructionally beneficial. The statistical data supports this claim as all posttest scores were significantly higher than all pretest scores.

Explicit instruction. Results of the study also suggest that it is important for teachers to make time for daily explicit vocabulary instruction. The daily vocabulary lessons in this study had three main parts: (1) explicit instruction from the teacher, (2)

collaboration among students, and (3) presentation of student work. Each day, regardless of whether students were learning with the digital or non-digital word wall, the vocabulary lesson began with explicit instruction. The results of the study indicate that explicit instruction is important to vocabulary acquisition and retention of Greek and Latin roots. Several researchers have written about the significance of explicit, or direct, instruction when teaching vocabulary (Beck & McKeown, 2007; Coyne et al., 2004; Dalton & Grisham, 2011; Rupley & Nichols, 2005; Taylor et al., 2009). In fact, Coyne, Simmons, Kame'enui, and Stoolmiller (2004) found that students with lower receptive vocabulary skills were found to have greater gains with explicit vocabulary instruction than their peers with higher receptive vocabulary skills. Their findings indicate that explicit instruction in vocabulary may help to narrow the ever-present vocabulary gap among students (Coyne, et al., 2004).

Furthermore, the National Reading Panel (2000) suggests that explicit vocabulary instruction, or teaching students specific words and meanings, is important in any classroom. Not only should explicit instruction be used for words that students will encounter in classroom texts, it should also be utilized to teach the meanings of words that students will come across in unanticipated texts (Stahl, 1986). Although this act of preparing students for unknown words may seem to be an impossible task, it is important to note that both the digital and non-digital word wall methods of instruction focused daily explicit instruction on Greek and Latin root meanings. The explicit instruction on Greek and Latin root meanings can impact students' ability to correctly decipher the meaning of unknown words in new texts.

At the core of the explicit, or direct, teaching method is “explicit explanation, modeling, and guided practice” (Rupley, Blair, & Nichols, 2009, p. 127). Rupley, Blair, and Nichols (2009) also maintain that academic engaged time is essential as well. In this study, teachers began each lesson with an introduction of the three roots which were to be studied for the week. Teachers then discussed the meanings, illustrations, and contextual references for each of the roots. After listening to the explicit instruction, students participated in academic engaged time each day as they worked collaboratively to build their digital or non-digital word walls. The findings from this study support the significance of explicit vocabulary instruction in the classroom. Students’ increased knowledge of the taught Greek and Latin roots was reflected in assessment scores.

Collaboration. After the explicit instruction portion of the lesson, students participated in daily collaboration. Therefore, results of this study also imply that student collaboration may be useful in connection with vocabulary acquisition and retention. The digital word wall utilized a wiki as a host. Wikis are useful tools that foster collaboration for the following reasons: (1) they are easily accessible, (2) they have previous versions stored on-site, and (3) they have comment areas that allow the co-authors to communicate (Meishar-Tal & Gorsky, 2010). Meishar-Tal and Gorsky (2010) found that students enjoyed using wikis because they could work together simultaneously or divide the labor and work at different times.

When setting up the study, the collaborative and social benefits of utilizing a wiki to teach vocabulary were acknowledged. It was postited by the researcher that the students, when using the wiki to collectively create their digital word walls, would experience exponential vocabulary growth. What was not considered, however, was that

students were working collaboratively on the non-digital word wall as well. For the non-digital word wall, students worked in groups to create their Frayer models that were then displayed on the wall of the classroom. This hypothesis on the importance of collaboration mirrors what Harmon et al. (2009) found in their study of non-digital interactive word walls. Harmon et al. (2009) discovered that students enjoyed being actively engaged and working together in collaborative groups.

Indeed, students should be members of learning communities so that they might learn with one another (Dalton & Grisham, 2011). Learning is a social process, and social interaction has a central role in the development of cognition (Vygotsky, 1978). While neither students nor teachers mentioned the collaboration piece during interviews, scores were significantly higher on all postassessments than they were on all preassessments. Although further research is needed to investigate this conclusion, the results of this study suggest that collaboration is an important piece of vocabulary instruction.

Technology. Integrating technology into daily classroom lessons is becoming increasingly important as Common Core State Standards are adopted. The digital word wall is one example of the kind of integration that supports the goals of the Common Core. Furthermore, the data from student and teacher interviews indicate that incorporating technology into vocabulary instruction increases students' engagement and motivation. Research regarding motivation has shown that students are more motivated to learn when they are actively engaged (Mountain, 2002; Mountain, 2007; Wells & Narkon, 2011) and interested in the instruction (Mountain 2002). The teachers both felt that students were more engaged in the digital method of instruction. In fact,

Ms. Lillian unambiguously stated that during the digital word wall instruction, the students in her class were, “more engaged.” Ms. Narris echoed Ms. Lillian’s declaration with her statement of “I think it’s more engaging for everybody and it’s more challenging.” While the students did not use the word *engaging*, five of the six interviewed preferred the digital word wall. Speculations as to why students find technology to be more motivating and engaging than traditional forms of instruction include: the technology (1) helps students to stay focused, (2) enables students to multitask, (3) makes learning fun, and (4) allows students to work together.

Keisha, a student in Class B, stated that using the computer helps her to “stay focused.” Keisha found that there were numerous distractions in the class that were not present when she was working on the digital word wall. When Keisha was on the computer, she felt that she was able to concentrate solely on the task at hand.

While some students, such as Keisha, enjoyed that the computer helped them stay focused, others appreciated that they were able to easily multitask when they used the digital word wall. Stephen, a student in Class B, discussed how he valued being able to have “all these things on one little screen.” Stephen also mentioned that with the digital word wall he could “do a lot” and “open new tabs to do more than one at a time.” Moreover, during the three weeks that students utilized the digital word wall, they also had access to online tools such as digital dictionaries and thesauri. One particular student in the study found the online dictionary much easier than the traditional. In fact, according to her resource teacher, the student struggled with sound-symbol relationships in the classroom. With the digital dictionary, the student was not required to understand the structure of a dictionary or sound-symbol relationships. She simply

had to type in the word and the definition was presented to her. Dalton and Grisham (2011) found that online tools were typically easier for students to use.

The students, in this study, discussed that they thought the technology made learning vocabulary more fun. Several of the students cited “games” as a reason for enjoying the computer during their down time. Stephen discovered that “sometimes you find new sites and even though they’re learning sites, it turns out to be pretty fun.” This suggests that students enjoy the learning websites that are disguised as games.

Several of the students involved in the study had access to and regularly engaged in social networking sites such as Facebook. Tyshaun mentioned using the computer to “talk to people” and Dori admitted to having Facebook page. One possible reason for the students being drawn to the digital word wall is that they were able to collaborate and function in an online setting. Many students enjoyed working together in the digital space.

Mountain (2002) explained that engagement and motivation make vocabulary learning more fun and therefore more powerful. While students found varying aspects of the walls appealing, engagement in the vocabulary activity was vital (Mountain, 2007). The data from this study suggest that most of the participating students felt more engaged when learning with the digital word wall.

Implications

There are several implications that can be gleaned from this study. First, if incorporating technology into vocabulary instruction is a viable way to promote engagement in students, schools need to ensure that students have access to the necessary technological tools. Second, teachers need to have quality professional

development available so that they are capable of using technology like that suggested in this study. Third, results suggest that it would be beneficial to encourage additional collaboration among teachers and researchers so that knowledge of how and when to utilize technology in the classroom might be shared. This collaboration could be fostered through a system of networking such as email, blogs, or social networking sites.

Tools. This study looked at the implications of embedding technology within vocabulary instruction. In order to utilize the technology in vocabulary teaching and learning, teachers and students must have access to various technological tools. The results imply that students would have more educational opportunities if they had greater access to technological tools such as computers, iPads, the Internet, etc. Fortunately, this study took place in a school with two computer labs, at least five computers in each classroom, and access to many other digital tools. Not all schools have this degree of technology available to teachers and students which presents challenges for some teachers to provide regular access to computers for their students (Benedis-Grab, 2011).

In fact, several researchers have reported on the digital divide that exists in and among schools (Hohlfeld, Ritzhupt, Barron, & Kemker, 2008; Henderson & Honan, 2008). While there has been targeted funding in the area of technology, on behalf of the government, a divide still exists between schools of differing socioeconomic status (SES) (Hohlfeld et al., 2008). In their four-year study of Florida's K-12 schools, Hohlfeld, Ritzhupt, Barron, and Kemker (2008) found that there remained significant differences among high and low SES schools in four areas: (1) student access to

software, (2) student use of software, (3) teacher use of software, and (4) level of technology support.

Benedis-Grab (2011) found that students' science knowledge grew exponentially when they collaborated digitally. The students in his study used Web 2.0 tools to participate in a plant growth experiment. With the utilization of the digital tools, students had increased access to data, and their ability to collaborate in an online forum led to greater conversations (Benedis-Grab, 2011). Although the Benedis-Grab (2011) study is a fairly recent one, there are numerous studies that describe the positive outcomes for student learning when students and teachers utilized technology. In fact, Cisco systems (2006) published a report that analyzed multiple research studies in order to provide educators and others with a look at what works in the realm of education and technology. They found that, "Overall, across all uses in all content areas, technology does provide a small, but significant, increase in learning when implemented with fidelity" (p. 15).With the positive outcomes readily apparent, it is important that students be given access to these technological tools.

Professional development. Having access to technological tools is necessary but not sufficient. Teachers must also know how to use and feel comfortable using the technology in their classrooms (Hohlfeld et al., 2008). Henderson and Honan (2008) observed two middle school classrooms in a low SES school. Although both teachers had computers in their classrooms, they used them intermittently (Henderson & Honan, 2008).

The digital divide, mentioned in the previous section, does not merely exist between schools. In reality, the digital divide can exist among teachers in the same

school (Hohlfeld et al., 2008). Hohlfeld et al. (2008) found that even if schools attempt to provide technology to their students, teachers may not have proficient technological skills to know "how to best integrate technology into the curriculum" (p. 1649).

Both of the teachers involved in this study were interested in incorporating technology into their lessons for the sake of their students. Ms. Narris discussed that one of her professional goals was "to continue learning, especially about technology." Ms. Lillian talked about how she found it exciting to teach with technology. She stated that the students grasp the technology "so much more quickly than I can learn it." Many teachers have the desire to learn new instructional techniques (Chen, 2012). However, lack of school or district funds can lead to fewer professional development opportunities. Furthermore, Cisco Systems (2006) cited lack of teacher training as one reason schools do not use technology as much as they could in the classroom.

A possible reason for the shortage of teacher training is that there are districts that lack the funds to send their teachers to far-away professional development. Renninger, Cai, Lewis, Adams, and Ernst (2011) found that, as long as certain guidelines are followed, online professional development can be a viable option for teachers in this situation. It is crucial that the developers of this online professional development ensure the participating teachers have multiple ways of thinking about and working with the content. Participants must be given an opportunity to engage in active hands-on instruction in implementing technology and not passive professional development such as reading about or viewing videos about using technology (Crow, 2010).

Networking. One of the conclusions in this study was that collaboration appeared to be positive for student learning. If collaboration has positive repercussions for students, it seems probable that collaboration would be beneficial for teachers as well. While teacher collaboration falls outside the scope of the data and findings of this study, other research demonstrates the immense power of collaboration in teaching (DiPardo, 1998). Therefore, a fourth implication of this study is that increased networking among educator professionals may result in more educational opportunities for students. Olsen, Donaldson, and Hudson (2012) found that "networking with colleagues enables early childhood educators to share their success stories and glean best-practice ideas from each other" (p. 16).

One way to increase networking opportunities is for teachers to take advantage of the immense Web 2.0 resources. This networking in an online forum is typically referred to as social networking. Boyd and Ellison (2007) defined social networking sites as "web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system" (p. 211). According to Chen (2012), the term *social networking* typically refers to using online sites such as a wiki, a blog, Facebook, and/or Twitter to communicate.

Wang, Woo, Quek, Yang, and Liu, (2012) found that not all social networking sites are created equal when it comes to satisfying the requirements of educators. While some social networking sites, such as Facebook, are great for making announcements or sharing techniques, they are less suited to educational needs (Wang, et al., 2012).

Limitations of Facebook include that the discussions are not threaded and certain files are not able to be uploaded (Wang, et al., 2012).

Using specific social networking sites, blogs, or even email might serve to allow educators to easily communicate and more rapidly glean ideas from one another. In fact, utilizing Web 2.0 tools can be an incredibly powerful way to share information and network among educators and researchers (Crow, 2010). These tools can be a way for those involved to learn from each other (Crow, 2010). Therefore, perhaps one way to further learning opportunities is to continue to open up the lines of communication between educators, specifically through the use of social networking sites.

Limitations

It is important to point out prospective issues with any study (Huck, 2008). There were several limitations to the present study. In fact, the researcher identified three main limitations: (1) the small size of the sample, (2) the researcher's involvement in the study as both a researcher and teacher at the school, and (3) the length of the study.

First of all, the size of the sample was relatively small. This led to a small degree of power. With an insufficient sample size, the researcher may conclude that there is no effect when there could have been one (Huck, 2008). The study consisted of 43 students and two teachers in a Southeastern suburban elementary school. While the results should be used to inform the instruction at the local level of the school, the results gleaned from this study should not be generalized to other populations. However, as will be presented in the next section, this limitation is an area which could inspire additional research.

Second, as a teacher at the research site, the researcher conducted the study with her colleagues. At the time of the study, the researcher and the participating teachers had been working together for several years. While the researcher did her best to convince both students and teachers that they could be completely open and honest during the interview process, the researcher's excitement about the unexplored possibility of a digital word wall in the school had not been concealed. Additionally, parents may have felt obligated to allow their children to participate in the study. The researcher did assure parents and students that there was absolutely no penalty for not participating. Although no participants withdrew, the researcher did remind them that the possibility existed if they were interested.

Although being a researcher and member of the school community did have its limitations, there was a positive side as well. The traditional, uninformed vocabulary instruction that had been utilized previously is no longer being used. Instead of students getting a few minutes of Greek and Latin root instruction once a week, teachers at the school have decided that students learned much better through the digital and non-digital word walls. Currently, five fifth grade teachers, at the school in which the study was conducted, have expressed interest in instructing students with the word wall approach.

The third limitation was treatment replication. Specifically, the study only lasted for eight-weeks. Ideally, the study would have been of a more significant duration. However, with spring break and state tests looming, the principal, participating teachers, and the researcher decided that eight-weeks had to be a sufficient length of time for this study.

Suggestions for Further Research

The aforementioned limitations provide several opportunities for future research. In order to expand upon the current study's research findings, future researchers could: (1) utilize a more diverse or larger sample size, (2) participate solely as researchers, (3) study the effects of a digital word wall for a longer duration of time, and (4) refine measures.

The sample size of the current study was relatively small and therefore provided numerous prospects for future research. The sample was two intact classes of heterogeneous, mixed-ability students. It would be interesting for the study to be replicated with a dissimilar sample. Suggestions for additional samples include: all females, all males, strictly minorities, exceptional students, younger students, or older students. Furthermore, it would be beneficial to conduct the study with a larger sample size as power would then be increased. An entire grade level, school, or perhaps district could be studied.

It would be more time efficient and would decrease the limitations of the study to have the researcher act solely as the researcher. While having established relationships at the research site may have put some interviewees at ease, it could have also affected the answers given to the researcher. Being a part of that school community had to have an effect on the results. It would be interesting to replicate the study without that existing relationship and chronicle the results.

The contributions to the field could be greatly augmented by conducting the study for a longer period of time. While the specific length of future studies is left up to prospective researchers, this researcher suggests conducting the study for a semester. At

the culmination of the semester, the future researchers could give the assessments. At the end of the following semester, they could again administer the assessments to test for retention. It would be interesting to study the effects of a longer period of time on retention.

Additionally, future research could involve refining measures. Specifically, future researchers could parse out different aspects of motivation in regards to the digital word wall. Researchers could measure the time each student spent on the digital word wall as compared to the non-digital word wall. Also, researchers could tally the number of times students were distracted with the digital word wall as compared to the non-digital word wall. This would aid in quantifying the degree of motivation and engagement students experience with the digital word wall.

Overall, continued research in the areas of vocabulary acquisition, retention, and motivation is essential. Teachers and researchers know that motivation is important to vocabulary acquisition (Mountain, 2002) and that social context and a social purpose for learning vocabulary is essential (Wells & Narkon, 2011). The task for researchers and educators is to continue to find additional methods of instruction and to expand upon those that are currently utilized in order to motivate our students.

Summary

Both vocabulary and technology are gaining prominence in the field of education as the Common Core State Standards (CCSS) are adopted. The National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO) (2010) have released that there are currently 45 states and three territories that have formally adopted the CCSS. The CCSS document

encourages both the integration of technology into daily lessons and the utilization of Greek and Latin roots to determine the meanings of unknown words (NGA Center & CCSSO, 2010). With the increased attention on these two items, the digital word wall may remain a practical option for teachers and students to use for vocabulary teaching and learning.

The teachers and students in this study felt that the digital word wall increased engagement in vocabulary instruction of the learners involved. Students learn more vocabulary in school when they are actively engaged in the instruction (Beck, McKeown, & Kucan, 2002; Mountain, 2007). It is unfortunate, then, that most of the vocabulary instruction that takes place within classrooms can be rather boring and tedious (Beck et al., 2002). Students are learning words, the most commonly cited number is seven new words per day, but Beck, McKeown, & Kucan (2002) point out that this figure is an average. While some children may be learning seven, or possibly even more words a day, many children are learning fewer and perhaps none at all. This only serves to increase the vocabulary gap (Biemiller & Boote, 2006). While too many words exist to teach them all in school (Beck et al., 2002), Rasinski et al. (2011) found that teaching students Greek and Latin roots is an efficient way to make a large impact on students' vocabularies. They are able to use knowledge gained from the study of Greek and Latin roots to decipher the meanings of countless other words (Rasinski, et al., 2011).

The conclusions from this study are that word walls, explicit instruction, collaboration, and technology can positively affect vocabulary acquisition, retention, and motivation. In order for there to be a positive impact on vocabulary instruction,

increased access to technological tools is important. Also, teachers need additional professional development as well as greater opportunities to network. The limitations of the study informed the possibilities for future research.

REFERENCES

Allen, J. (1999). Words, words, words: Teaching vocabulary in grades 4-12. York, ME: Stenhouse Publishers.

Alvermann, D.E. (2008). Commentary: Why bother theorizing adolescents' online literacies for classroom practice and research? Journal of Adolescent & Adult Literacy, 52, 8-19. doi: 10.1598/JAAL.52.1.2

Alvermann, D.E., & Phelps, S.F. (2002). Content Reading and Literacy: Succeeding in Today's Diverse Classrooms (3rd ed.). Boston, MA: Allyn & Bacon.

Anderson, L.W., & Krathwohl, D.R. (2001). A taxonomy for learning, teaching, and assessing: A revision of Bloom's Taxonomy of educational objectives: Complete Edition. New York: Longman.

Anderson, R. C., & Freebody, P. (1981). Vocabulary knowledge. In J. T. Guthrie (Ed.), Comprehension and teaching: Research reviews (pp. 77-117). Newark, DE: International Reading Association

Anderson, R.C., & Freebody, P. (1985). Vocabulary knowledge. In H. Singer & R.B. Ruddell (Eds.), Theoretical models and processes of reading (3rd ed., pp. 343-371). Newark, DE: International Reading Association.

Anderson, R.C., & Nagy, W.E. (1992). The vocabulary conundrum. American Educator, Winter, 14-18, 44-47.

Arter, L.M., & Nilsen, A.P. (2009). Using Lemony Snicket to bring smiles to your vocabulary lessons. The Reading Teacher, 63(3), 235-238. doi: 10.1598/RT.63.3.6

Baker, S.K., Simmons, D.C., & Kameenui, E.J. (1995). Vocabulary acquisition: Curricular and instructional implications for diverse learners. Technical Report No. 13. Oregon: National Center to Improve the Tools for Educators.

Bakhtin, M. (1981). The dialogic imagination: Four essays (M. Holquist, Ed., C. Emerson & M.Holquist, Trans.). Austin: University of Texas Press.

Beck, I.L., & McKeown, M.G. (1991). Conditions of vocabulary acquisition. In R.E. Barr, M.L.E. Kamil, P. Mosenthal, & P. Pearson (Eds.), Handbook of reading research (Vol. 2, pp. 789- 814). Hillsdale, NJ: Erlbaum.

Beck, I.L., McKeown, M.G. (2007). Increasing young low income children's oral vocabulary repertoires through rich and focused instruction. The Elementary School Journal, 107, 251-271.

Beck, I.L., McKeown, M.G., & Kucan, L. (2002). Bringing words to life: Robust vocabulary instruction. New York: The Guilford Press.

Benedis-Grab, G. (2011). Sharing digital data: A plant growth experiment is strengthened when students collaborate digitally. Science and Children, 42-47.

Berne, J.L., & Blachowicz, C.L.Z. (2008). What reading teachers say about vocabulary instruction: Voices from the classroom. The Reading Teacher, 62, 314-323.

Biemiller, A. (2001). Teaching vocabulary: Early, direct, and sequential. American Educator, 25, 24-28, 47.

Biemiller, A., & Boote, C. (2006). An effective method for building meaning vocabulary in primary grades. Journal of Educational Psychology, 98, 44-62.

Blachowicz, C.L.Z., Beyersdorfer, J., & Fisher, P. (2006). Vocabulary development and technology: Teaching and transformation. In M.C. McKenna, L.D. Labbu, R. Kieffer, & D. Reinking (Eds.) International handbook of literacy and technology (Vol. 3). Hillsdale, NJ: Erlbaum.

Blachowicz, C. L. Z., Fisher, P. J. (2006). Teaching vocabulary in all classrooms. Upper Saddle, NJ: Pearson Education.

Baumann, J.F., Edwards, E.C., Font, G., Tereshinski, C.A., Kame'enui, E.J., Olejnik, S. (2002). Teaching morphemic and contextual analysis to fifth-grade students. Reading Research Quarterly, 37, 150-176.

Baumann, J.F., & Kameenui, E.J. (1991). Research on vocabulary instruction: Ode to Voltaire. In J. Flood, J.M. Jensen, D. Lapp, & J.R. Squire (Eds.). Handbook of research on teaching the English language arts (pp. 604-32). New York: Macmillan.

Baumann, J. F., Kameenui, E. J., & Ash, G. E. (2003). Research on vocabulary instruction: Voltaire redux. In J. Flood, J. M. Jensen, D. Lapp, & J. R. Squire (Eds.), Handbook of research on teaching the English language arts (2nd ed., pp. 752-785). Mahwah, NJ: Lawrence Erlbaum.

Boyd, D. M., & Ellison, N. B. (2007). Social network sites: Definition, history, and scholarship. Journal of Computer-Mediated Communication, 13, 210-230. doi:10.1111/j.1083-6101.2007.00393.x

Brabham, E.G., & Villaume, S.K. (2001). Questions and answers: Building walls of words. The Reading Teacher, 54, 700-703.

Bryant, D.P., Goodwin, M., Bryant, B.R., & Higgins, K., (2003). Vocabulary instruction for students with learning disabilities: A review of the research.

Learning Disability Quarterly, 26, 117-12.

Chall, J.S., & Jacobs, V.A. (1983). Writing and reading in the elementary grades: Developmental trends among low-SES children. Language Arts, 60 (5), 617-626.

Chall, J. & Jacobs, V.A. (2003). The classic study on poor children's fourth-grade slump. American Educator, 27(1), 14-15.

Chall, J.S., Jacobs, V.A., & Baldwin, L.E. (1990). The Reading Crisis: Why Poor Children Fall Behind. Cambridge, Mass.: Harvard University Press.

Chen, L. (2012). Improving teachers' teaching with communication technology. Journal of Educational Technology Systems, 40, 35-43. doi: 10.2190/ET.40.1.D

Chen, N., Quadir, B., & Teng, D.C. (2011). Integrating book, digital content, and robot for enhancing elementary school students' learning of English. Australian Journal of Educational Technology, 27, 546-561.

Cisco Systems. (2006). Technology in schools: What the research says. Retrieved from http://www.cisco.com/web/strategy/docs/education/TechnologyinSchools Report.pdf

Coiro, J., Knobel, M., Lankshear, C., & Leu, D.J. (Eds.). (2008). Handbook of research on new literacies. Mahwah, NJ: Erlbaum.

Collins, A., & Halverson, R. (2009). Rethinking education in the age of technology: The digital revolution and schooling in America. New York: Teachers College Press.

Cope, B., & Kalantzis, M. (2000). Introduction: Multiliteracies: The beginnings of an idea. In B. Cope and M. Kalantzis (Eds.). Multiliteracies: Literacy learning and the design of social futures (pp. 1-8). London: Routledge.

Coyne, M.D., Kame'enui, E.J., & Carnine, D.W. (2007). Effective teaching strategies for accommodating diverse learners (3rd ed.). Upper Saddle River, NJ: Pearson.

Coyne, M.D., Simmons, D.C., Kame'enui, E.J., & Stoolmiller, M. (2004). Teaching vocabulary during shared storybook readings: An examination of differential effects. Exceptionality, 12, 145-162.

Creswell, J. W. (2009). Research design: Qualitative, quantitative, and mixed-method approaches. Thousand Oaks, CA: Sage.

Creswell, J.W., & Plano Clark, V.W. (2011). Designing and conducting mixed methods research (2nd ed.). Los Angeles: SAGE.

Crow, T. (2010). Learning, no matter where you are: Q & A with Chris Dede. Journal of Staff Development, 31, 10-17.

Cunningham, A.E., & Stanovich, K.E. (1997). Early reading acquisition and its relation to reading experience and ability 10 years later. Developmental Psychology, 33, 934-945.

Cunningham, P.M., (2000). Phonics they use: Words for reading and writing. New York: Longman.

Dale, E. (1965). Vocabulary measurement: Techniques and major findings. Elementary English, 42(8), 895-901.

Dalton, B., & Grisham, D.L. (2011). eVoc strategies: 10 ways to use technology to build vocabulary. The Reading Teacher, 64, 306-317. doi: 10.1598/RT.64.5.1

Deforest, J. (2000). Greek and Latin roots: Roots, prefixes, and suffixes. Michigan State University. Retrieved June 28, 2011 from: https://www.msu.edu/~defores1/gre/roots/gre_rts_afx2.htm

Dipardo, A. (1998). Teaching in common: Challenges to joint work in classrooms and schools New York: Teachers College Press.

Dreon, O., Kerper, R., & Landis, J. (2011). Digital storytelling: A tool for teaching and learning in the Youtube generation. Middle School Journal, 42(5), 4-9.

Ebbers, S.M., & Denton, C.A. (2008). A root awakening: Vocabulary instruction for older students with reading difficulties. Learning Disabilities Research & Practice, 23, 90-102.

Edwards, E.C., Font, G., Baumann, J.F., & Boland, E. (2004). Unlocking word meanings: Strategies and guidelines for teaching morephemic and contextual analysis In J.F. Baumann & E.J. Kame'enui (Eds.), Vocabulary instruction: Research to practice (pp. 159-176). New York: The Guilford Press.

Ezzy, D. (2002). Qualitative analysis: Practice and innovation. London: Routledge.

Fisher, D. (2007). Creating a school-wide vocabulary initiative in an urban high school. Journal of Education for Students Placed at Risk, 12 (3), 337-351.

Fraga, L., Harmon, J. M., Wood, K. D., & Buckelew-Martin, E. (2011). Digital word walls and vocabulary learning: The use of iPods to facilitate vocabulary instruction with ESL students. Journal of the Research Center for Educational Technology, 7(2), 38-57. Retrieved from http://www.rcetj.org/index.php/rcetj/issue/current

Frayer, D.A., Frederick, W.D., & Klausmeier, H.J. (1969). A schema for testing the level of concept mastery (Working Paper No. 16). Madison: Wisconsin Research and Development Center for Cognitive Learning.

Friedman, T.L. (2007). The world is flat: A brief history of the twenty-first century. New York: Picador/ Farrar, Straus and Giroux.

Glesne, C. (2006). Becoming qualitative researchers: An introduction (3rd ed.). Boston: Pearson Education, Inc.

Graves, M.F. (2004). Teaching prefixes: As good as it gets? In J.F. Baumann & E.J. Kame'enui(Eds.), Vocabulary instruction: Research to practice (pp. 81-99). New York: The Guilford Press.

Graves, M.F. (2009). Teaching individual words: One size does not fit all. Newark, DE: International Reading Association.

Green, J. (2003). The word wall: Teaching vocabulary through immersion. Toronto: Ontario: Pippin Publishing.

Guthrie, J.T., Wigfield, A., Humenick, N.M., Perencevich, K.C., Taboada, A., & Barbosa, P. (2006). Influences of stimulating tasks on reading motivation and comprehension. The Journal of Educational Research, 99, 232- 245.

Hall, W.S., Nagy, W.E., &Linn, R. (1984). Spoken words: Effects of situation and social group on oral word usage and frequency. Hillsdale, NJ: Erlbaum.

Halliday, M.A.K. (1993). Towards a language-based theory of learning. Linguistics and Education, 5, 93- 116.

Harmon, J.M., Hendrick, W.B., Wood, K.D., Vintinner, J., & Willeford, T. (2009). Interactive word walls: More than just reading the Writing on the walls. Journal of Adolescent and Adult Literacy, 52, 398-408.

Harris, T.L., & Hodges, R.E. (Eds.). (1995). The literacy dictionary: The vocabulary of reading and writing. Newark, DE: International Reading Association.

Hart, B., & Risley, R.T. (1995). Meaningful differences in the everyday experiences of young American children. Baltimore: Paul H. Brookes.

Hebert, B. M., & Murdock, J. Y. (1994). Comparing three computer-aided instruction output modes to teach vocabulary words to students with learning disabilities. Learning Disabilities Research Practice, 9, 135-141.

Heilman, M., Collins-Thompson, K., callan, J., Eskenazi, M., Juffs, A., & Wilson, L. (2010). Personalization of reading passages improves vocabulary acquisition.

International Journal of Artificial Intelligence in Education, 20, 73-98.

Henderson, R., & Honan, E. (2008). Digital literacies in two low socioeconomic classrooms: Snapshots of practice. English Teaching: Practice and Critique, 7, 85-98.

Hohlfeld, T.N., Ritzhaupt, A.D., Barron, A.E., Kemker, K. (2008). Examining the digital divide in K-12 public schools: Four year trends for supporting ICT literacy in Florida.Computers & Education, 51, 1648-1663.

Holmes, C. T. & Keffer, R. L. (1995). A computerized method to teach Latin and Greek root words: Effect on verbal SAT scores. The Journal of Educational Research, 89, 47-50.

Huck, S.W. (2008). Reading statistics and research (5th ed.). New York: Pearson.

International Reading Association. (2009). New literacies and 21st century technologies (Position Statement). Newark, DE: Author. Retrieved February 13, 2012 from www.Reading.org/general/aboutIRA/positionstatements/21stcenturyliteracies.aspx

Jasmine, J., & Schiesl, P. (2009). The effects of word walls and word wall activities on the reading fluency of first grade students. Reading Horizons, 49, 301- 314.

Jensen, A., (1980). Bias in mental testing. New York: Free Press.

Kamil, M.L., Borman, G.D., Dole, J., Kral, C.C., Salinger, T., & Torgensen, J. (2008). Improving adolescent literacy: Effective classroom and intervention practices: A practical guide (NCEE # 2008-4207). Washington DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. Retrieved from http://ies.ed.gov

Koppenhaver, D. A., & Erickson, K. A. (2003). Natural emergent literacy supports for preschoolers with autism and severe communication impairments. Topics in Language Disorders, 23(4), 283-292.

Kukulska-Hulme, A., & Pettit, J. (2009). Practitioners as innovators: Emergent practice in personal mobile teaching, learning, work and leisure. In M. Ally (Ed.), Mobile Learning: transforming the delivery of education and training. Issues in Distance Education (pp. 135-155.). Athabasca, Alberta: Athabasca University Press.

Lankshear, C., & Knobel, M. (2006). New literacies: Everyday practices and classroom learning (2nd ed.). New York: Maidenhead.

Lave, J., & Wenger, E. (1991). Situated learning: Legitimate peripheral participation. New York: Cambridge University Press.

Lisenbee, P. (2009). Whiteboards and websites: Digital tools for the early childhood curriculum. Young Children, 92-95.

Liu, M., Moore, Z., Graham, L. & Lee, S. (2003). A look at the research on computer-based technology use in second language learning: A review of the literature from 1990-2000. Journal of Research on Technology in Education, 34(3), 250-273.

Luke, C. (2000). Cyber-schooling and technological change: Multiliteracies for new times. In B. Cope and M. Kalantzis (Eds.). Multiliteracies: Literacy learning and the design of social futures (pp. 69-91). London: Routledge.

Manzo, A. V., Manzo, U. C., & Thomas, M. M. (2006). Rationale for systematic vocabulary development: Antidote for state mandates. Journal of Adolescent & Adult Literacy, 48(7), 610–619.

Meishar-Tal, H., & Gorsky, P. (2010). Wikis: What students do and do not do when writing collaboratively. Open Learning, 25, 25-35.

Merriam, S. (1997). Chapter 1. In Qualitative research and case study application in education (2nd ed.). New York: Jossey-Bass.

Merriam-Webster's collegiate dictionary (11th ed.). (2005). Springfield, MA: Merriam-Webster.

Moore, M., & Calvert, S. (2000). Brief report: Vocabulary acquisition for children with autism: Teacher or computer instruction. Journal of Autism and Developmental Disorders, 30 (4),359-362.

Mountain, L. (2002). Flip-a-chip to build vocabulary. Journal of Adolescent & Adult Literacy, 46, 62-68.

Mountain, L. (2005). ROOTing out meaning: More morphemic analysis for primary pupils. The Reading Teacher, 58(8), 742–749. doi: 10.1598/RT.58.8.4

Mountain, L. (2007). Synonym success- Thanks to the thesaurus. Journal of Adolescent & Adult Literacy, 51, 318-324. doi: 10.1598/JAAL.51.4.3

Nagy, W.E. (1988). Teaching vocabulary to improve reading comprehension. Urbana, IL: ERIC Clearinghouse on Reading and Communication Skills.

Nagy, W.E., & Anderson, R.C. (1984). How many words are there in printed school English? Reading Research Quarterly, 19, 304-330.

Nagy, W., Berninger, V.W., & Abbott, R.D. (2006). Contributions of morphology beyond phonology to literacy outcomes of upper elementary and middle-students. Journal of Educational Psychology, 98, 134-147. doi: 10.1037/0022-0663.98.1.134

Nagy, W., Berninger, V., Abbott, R., Vaughan, K., & Vermeulen, K. (2003). Relationship of morphology and other language skills to literacy skills in at-risk second-grade readers and at-risk fourth-grade writers. Journal of Educational Psychology, 95, 730-742. doi: 10.1037/0022-0663.95.4.730.

Nagy, W.E., & Diakidoy, I.N., & Anderson, R.C. (1993). The acquisition of morphology: Learning the contribution of suffixes to the meanings of derivatives. Journal of Reading Behavior, 25, 155-170.

Nagy, W.E., Herman, P., & Anderson, R. (1985). Learning words from context. Reading Research Quarterly, 20, 233-253.

Narkon, D.E., Wells, J.C., & Segal, L.S. (2011). E-word wall: An interactive vocabulary instruction tool for students with learning disabilities and autism spectrum disorders. Teaching Exceptional Children, 43 (4), 38-45.

National Center for Education Statistics (2009).The Nation's Report Card: Reading 2009(NCES 2010–458). Institute of Education Sciences, U.S. Department of Education, Washington, D.C.

National Center for Education Statistics (2012). Reading performance: Indicator 23-2012. Retrieved from http://nces.ed.gov/programs/coe/indicator_rd2.asp

National Center for Reading First Technical Assistance (2008). Effective vocabulary instruction: A Reading First technical brief (US Department of Education Contract No. ED- 03- CO- 0082). Retrieved from http://www.ed.gov/programs/readingfirst/support/index.html.

National Governors Association Center for Best Practices and the Council of Chief State School Officers. (2010). Common core state standards for English language arts.

National Governors Association Center for Best Practices, Council of Chief State School Officers, Washington D.C. Retrieved on July 15, from: www.corestandards.org

National Institute of Child Health and Human Development. (2000). Report of the National Reading Panel: Teaching children to read: An evidence based assessment of the scientific research literature on reading and its

implications for reading instruction. Retrieved on June 29, from: http://www.nichd.nih.gov/publications/nrp/smallbook.htm

New London Group. (1996). A pedagogy of multiliteracies: Designing social futures. Harvard Educational Review, 6,60-92.

Nichols W. D., & Rupley, W. H. (2004) Matching instructional design with vocabulary instruction. Reading Horizons, 45(1), 55-71.

O'Brien, D., & Scharber, C. (2008). Digital literacies go to school: Potholes and Possibilities. Journal of Adolescent and Adult Literacy, 52, 66-68. doi: 10.1598/JAAL.52.1.7

Olsen, H., Donaldson, A.J., Hudson, S.D. (2010). Online professional development: Choices for early childhood educators. Dimensions of Early Childhood, 38, 1-17.

Patten, M.L. (2005). Understanding research methods: An overview of the essentials (5th ed.). Glendale, CA: Pyrczak Publishing.

Patten, K.B. & Craig, D.V. (2007). iPods and English-language learners: A great combination. Teacher Librarian: The Journal for School Library Professionals, 34, 40 – 44.

Paynter, D.E., Bodrova, E., Doty, J.K. (2005). For the love of words: Vocabulary instruction that works, grades K-6. San Francisco, CA: Jossey-Bass.

Pegrum, M. (2009). From blogs to bombs: The future of digital technologies in education. Crawley, Western Australia: UWA Publishing.

Petty, W., Herold, C., & Stoll, E. (1967). The state of knowledge about the teaching of vocabulary. Urbana, IL: National Council of Teachers of English.

RAND Reading Study Group. (2002). Reading for understanding: Toward and R & D program in reading comprehension. Santa Monica, CA: Rand Education.

Rasinski, T.V., Padak, N., Newton, J., & Newton, E. (2011). The Latin-Greek connection: Building vocabulary through morphological study. The Reading Teacher, 66, 133-141.

Renninger, K.A., Cai, M., Lewis, M.C., Adams, M.M., Ernst, K.L. (2011). Motivation and learning in an online, unmoderated mathematics workshop for teachers. Education Technology Research Development, 59, 229-247. doi: 10.1007/511423-011-9195-4

Richardson, W. (2006). Blogs, wikis, podcasts, and other powerful web tools for the

classroom. Thousand Oaks, CA: Corwin Press.

Robb, L. (2009). Reading strategy lessons for science and social studies. New York, NY: Scholastic.

Rupley, W.H., Blair, T.R., & Nichols, W.D. (2009). Effective reading instruction for struggling readers: The role of direct/explicit teaching. Reading & Writing Quarterly, 25, 125-138. doi: 10.1080/10573560802683523

Rupley, W.H., & Nichols, W.D. (2005). Vocabulary instruction for the struggling reader. Reading & Writing Quarterly, 21 (3), 239-260.

Scanlon, M., Buckingham, D., & Burn, A. (2005). Motivating maths? Digital games and mathematical learning. Technology, Pedagogy and Education, 14(1), 127-139.

Shannon, P. (2007). Reading against democracy: The broken promises of reading instruction. Portsmouth, NH: Heinemann.

Smith, N.B. (1934). American reading instruction. New York: Silver-Burdett.

Snow, C.E., Burns, M.S., & Griffin, P. (Eds.). (1998). Preventing reading difficulties in young children. Washington, DC: National Academy Press.

Stahl, K.A.D., & Bravo, M.A., (2010). Contemporary classroom vocabulary assessment for content areas. The Reading Teacher, 63(7), 566-578. doi:10.1598/RT.63.7.4

Stahl, S. A. (1986). Three principles of effective vocabulary instruction. Journal of Reading, 29, 662–668.

Stahl, S. A., & Kapinus, B. (2001).Word power: What every educator needs to know about teaching vocabulary. Washington, DC: National Education Association.

Stahl, S. A., & Nagy, W. E. (2006). Teaching word meanings. Mahwah, NJ: Lawrence Erlbaum.

Stauffer, R.G. (1942). A study of prefixes in the Thorndike list to establish a list of prefixes that should be taught in the elementary school. Journal of Educational Research, 35, 453-358.

Tashakkori, A., & Teddlie, C. (Eds.). (2003). Handbook of mixed methods in social & behavioral research. Thousand Oaks, CA: Sage.

Taylor, D.B., Mraz, M., Nichols, W.D., Rickelman, R.J., & Wood, K.D. (2009). Using explicit instruction to promote vocabulary learning for struggling readers.

Reading & Writing Quarterly, 25, 1-16.

Thompson, E. (1958). The "master word" approach to vocabulary training. Journal of Developmental Reading, 2, 62--66.

Thorndike, E.L. (1932). The teacher's word book of 20,000 words. New York: Teachers College Press.

Vygotsky, L.S. (1978). Mind in society: The development of higher psychological processes (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds. And Trans.). Cambridge, MA: Harvard University Press.

Vygotsky, L. (1986). Thought and language. Cambridge, MA: MIT Press.

Wang, Q., Woo, H.L., Quek, C.L., Yang, Y., & Liu, M. (2012). Using the Facebook group as a learning management system: An exploratory study. British Journal of Educational Technology, 43, 428-438.

Wanzek, J., Wexler, J., Vaughn, S., & Cuillo, S. (2010). Reading interventions for struggling readers in the upper elementary grades: A synthesis of 20 years of research. Reading & Writing: An Interdisciplinary Journal, 23 (8), 889-912.

Wells, G. (1986). The meaning makers. Portsmouth, NH: Heinemann Educational Books.

Wells, G. (2000). Dialogic inquiry in education: Building on the legacy of Vygotsky. In C.D. Lee & P. Smagorinsky (Eds.) Vygotskian perspectives on literacy research. New York: Cambridge University Press, (pp. 51-85).

Wells, J.C., & Narkon, D. E. (2011). Motivate students to engage in word study using vocabulary games. Intervention in School and Clinic, 47, 45-49. doi: 10.1177/1053451211407493

Wertsch, J.V. (2002). Voices of collective remembering. Cambridge, England: Cambridge University Press.

Wesche, M., & Paribakht, T.S. (1996). Assessing second language vocabulary knowledge: Depth versus breadth. Canadian Modern Language Review, 53(1), 13-40.

Whitaker, S. (2008). Word play: Building vocabulary across texts and disciplines grades 6-12. Portsmouth, NH: Heinemann.

White, T.G., Graves, M.F., & Slater, W.H. (1990). Growth of reading vocabulary in diverse elementary schools: Decoding and word meaning. Journal of

Educational Psychology, 82, 281-290.

White, T.G., Power, M.A., & White, S. (1989). Morphological analysis: Implications for teaching and understanding vocabulary growth. Reading Research Quarterly, 24, 283-304.

White, T.G., Sowell, J., & Yanagihara, A. (1989). Teaching elementary students to use word part clues. The Reading Teacher, 42, 302-308.

Williams, B.T. (2008). “Tomorrow will not be like today”: Literacy and identity in a world of multiliteracies. Journal of Adolescent and Adult Literacy, 51, 682-688.

Wolcott, Harry F. (1990). On seeking-and rejecting- validity in qualitative research. In Elliot W. Eisner & Alan Peshkin (Eds.), Qualitative inquiry in education: The continuing debate (pp. 121-152). New York: Teachers College Press.

Wood, K.D., Harmon, J., Taylor, D.B. (2011). Guidelines for integrating comprehension-based word study in content classrooms. Middle School Journal, 42, 57-64.

Wysocki, K., & Jenkins, J. (1989). Deriving word meanings through morphological generalization. Reading Research Quarterly, 22, 66-81.

Yates, P.H., Cuthrell, K., & Rose, M. (2011). Out of the room and into the hall: Making content word walls work. The Clearing House, 84, 31-36. doi: 10.1080/00098655.2010.496810

Zutell, J. (2008). Changing perspectives on word knowledge: Spelling and Vocabulary. In M.J. Fresch (Ed). An essential history of current reading practices (pp. 186-206). Newark, DE: International Reading Association.

APPENDIX A: IRB APPROVAL

UNC CHARLOTTE

Office of Research Compliance

9201 University City Boulevard, Charlotte, NC 28223-0001
T: 704.687.3309 | F: 704.687.3982 | http://research.uncc.edu/research-compliance-ethics

Institutional Review Board (IRB) for Research with Human Subjects

Certificate of Approval

Protocol #	**11-12-03**
Protocol Type:	**Expedited**
Title:	**The Effect of Digital Word Study on Fifth Graders' Vocabulary Acquisition, Retention, and Motivation: A Mixed Methods Approach**
Initial Approval:	**1/3/2012**
Responsible Faculty	**Dr. Karen Wood Reading & Elem Educ**
Investigator	**Ms. Lindsay SheronickYearta Reading & Elem Educ**

After careful review, the protocol listed above was approved by the Institutional Review Board (IRB) for Research with Human Subjects. This approval will expire one year from the date of this letter. In order to continue conducting research under this protocol after one year, the "Annual Protocol Renewal Form" must be submitted to the IRB. This form can be obtained from the Office of Research Compliance web page http://research.uncc.edu/compliance-ethics/human-subjects.

Please note that it is the investigator's responsibility to promptly inform the committee of any changes in the proposed research prior to implementing the changes, and of any adverse events or unanticipated risks to subjects or others. Amendment and Event Reporting forms are available on our web page at http://www.research.uncc.edu/Comp/human.cfm.

M. Lyn Exum — 1-9-12

Dr. M. Lyn Exum, IRB Chair — Date

APPENDIX B: TEACHER ASSIGNMENTS AND DEMOGRAPHICS

All names are pseudonyms.

Table B1: Pseudonym and Group Identity

Teacher Pseudonym	Group Identity
Ms. Lillian	1st 3 Weeks: Digital Word Wall 2nd 3 Weeks: Non-Digital Word Wall
Ms. Narris	1st 3 Weeks: Non-Digital Word Wall 2nd 3 Weeks: Digital Word Wall

Table B2: Demographic Data of Teacher Participants

Teacher Pseudonym	Age	Gender	Ethnicity	Years Teaching
Ms. Narris	52	F	White	20
Ms. Lillian	36	F	White	12

APPENDIX C: TIMELINE AND COMPONENTS OF STUDY

Table C1: Phases of the Study

Phase	Dates	Details
Phase 1	January 10, 2012 to January 13, 2012	I met with and spoke to the teachers. I described the study, the purpose, and what we hoped to contribute to the field. Training began at this time. I trained one teacher on the digital word wall and one on the non-digital word wall. Consent forms were given to the teachers. Assent and consent forms were given to the students.
Phase 2	January 16, 2012 to February 3, 2012	Students learned three Greek and Latin roots per week. Both groups, the digital word wall group and the non-digital word wall group, learned the same three roots. The following protocol was utilized: **The teacher for the digital word wall:** ___ Used the flipchart (similar to a PowerPoint, but displayed on the interactive white board), that the researcher created, to introduce the three Greek and Latin roots for the week. ___ Provided students (who had been placed in collaborative groups of 4-6) with laptop or desktop computers. ___ Allowed time for students to find words containing the Greek and Latin roots (approximately 10-20 minutes) and create digital modified Frayer models (one for each root). Students saved these digital modified Frayer models to the digital word wall (the wiki). ___ Pulled up the students' digital Frayer models on the interactive white board and allowed students time to present each digital modified Frayer model.

		___ Had the students present the digital modified Frayer model in the following manner, "Our root is_____. The meaning of our root is _____. Our example is _____. Our sentence is _____. Our illustration is _____." For example, "Our root is co. The meaning of our root is together. Our example is cooperate. Our sentence is: the two friends cooperated on a big project in school. Our illustration is of two friends girls leaning over a table and working on a project." ___ Wrapped up the lesson by going over the meaning of each root once more. **The teacher for the non-digital word wall:** ___ Used the flipchart (similar to a PowerPoint, but displayed on the interactive white board), that the researcher created, to introduce the three Greek and Latin roots for the week. ___ Posted the provided 3x5 index cards with the root and meaning for all three roots. ___ Provided students (in collaborative groups of 4-6) with dictionaries. ___ Allowed time for students to find words containing the Greek and Latin roots (approximately 10-20 minutes) and create modified Frayer models (one for each root). ___ Allowed the students time to present each modified Frayer model. ___ Had the students present the modified Frayer model in the following manner, "Our root is_____. The meaning of our root is

	February 3, 2012	_____. Our example is _____. Our sentence is _____. Our illustration is _____." For example, "Our root is co. The meaning of our root is together. Our example is cooperate. Our sentence is: the two friends cooperated on a big project in school. Our illustration is of two friends girls leaning over a table and working on a project." ___ Wrapped up the lesson by going over the meaning of each root once more. ___ Posted the modified Frayer models in a visible place in the classroom for students to see. (Frayer models were posted close to the 3x5 index cards which had the root and meaning of the root.) In effect, all *co* modified Frayer models should be clustered around the *co* 3x5 index card which was labeled: *co- together*. Students took both the multiple-choice and vocabulary knowledge scale assessments for the nine Greek and Latin roots they had been studying for the past three weeks. The researcher met with both teachers after school and trained them on the other instructional method. Class A's teacher was trained on the non-digital method and Class B's teacher was trained on the digital method.
Phase 3	February 6, 2012 to February 24, 2012 **February 24, 2012**	Teachers and students switched instructional methods. Students in Class A learned with the non-digital word wall and students in Class B learned with the digital word wall. The protocol outlined in phase two was utilized in phase three as well. Students took both the multiple-choice and vocabulary knowledge scale assessments for the nine Greek and Latin roots they had been studying

		for the past three weeks.
Phase 4	February 27, 2012 to March 9, 2012 **March 9, 2012**	The researcher conducted student and teacher interviews during this time period. Students took a culminating test which contained all six weeks of roots. (There were 18 roots total; 36 questions were on the multiple-choice assessment and 18 questions were on the Vocabulary Knowledge Scale Assessment) to measure for retention of words.

TABLE C2: Greek and Latin Roots: Words, Meanings, and Examples

Week	Words	Meanings	Examples
1	co	together	coworker cofound cohabitate coexist
	inter	between/among	international interfaith interact interfamilial intergalactic
	mis	wrong/bad	misinterpret misinform misfire mistreat mistrial
2	semi	one-half/partly	semi-sweet semi-circle semifinalist semisolid

			semitone semiyearly
	terra	earth	terrain terrarium territory terracotta terrestrial
	port	carry	porter portable transport report export import support transportation
3	audi	hear/listen	audiology auditorium audio audition audible
	dict	say/speak	dictation diction dictionary dictator edict predict verdict contradict

			benediction
	meter	measure	Thermometer barometer meter voltammeter
4	geo	earth	geometry geography geocentric geology
	spec/spect	look	specimen specific spectacle spectator speculate aspect inspect respect prospect retrospective introspective expect
	hydro	water	hydrate dehydration hydrant hydraulic hydrogen hydrophobia
5	sub	below/less	substandard

			subfloor subpar subheading subordinate
	graph	to write, something written	graphic graph autograph autobiography graphic graphite
	prim/prime	first	primal primitive primary primeval primer
6	omni	all, everything	omniscient omnipresent omnivore omnivorous omnipotent
	micro	small	microscope micromanage microorganism microscopic
	anti	against, the opposite of	antisocial antibiotic antivirus antiwar

			antithesis antiaircraft

Deforest, J. (2000). Greek and Latin roots: Roots, prefixes, and suffixes. Michigan State University. Retrieved June 28, 2011 from: https://www.msu.edu/~defores1/gre/roots/gre_rts_afx2.htm

Merriam-Webster's collegiate dictionary (11th ed.). (2005). Springfield, MA: Merriam-Webster.

APPENDIX D: MODIFIED FRAYER EXAMPLES

Meaning	***Example***
together	coworker
root CO	
Illustration	***Definition***
 *The coworkers collaborated on a large project in order to finish on time.*	To work together

Meaning	***Example***
between/among	interact

root
INTER

Illustration	***Definition***
 *The students were interacting before the bell rang for class to begin.*	To work with or talk to others

Frayer, D.A., Frederick, W.D., & Klausmeier, H.J. (1969). A schema for testing the level of concept mastery (Working Paper No. 16). Madison: Wisconsin Research and Development Center for Cognitive Learning.

Graves, M.F. (2009). Teaching individual words: One size does not fit all. Newark, DE: International Reading Association.

Paynter, D.E., Bodrova, E., Doty, J.K. (2005). For the love of words: Vocabulary instruction that works, grades K-6. San Francisco, CA: Jossey-Bass.

APPENDIX E: VOCABULARY KNOWLEDGE SCALE ASSESSMENT

This assessment encourages students to think about their levels of word knowledge by assessing themselves (Baumann, Kameenui, & Ash, 2003; Dale, 1965; Stahl & Bravo, 2010; Wesche & Paribakht, 1996).

Name:_____ Date:_____

Directions: Circle the letter that best describes your knowledge of the root word. If you circle c, d, or e: also fill in the blank. This is not a grade. The purpose of this assessment is to determine your knowledge level so that we can better tailor instruction to meet your needs.

1. co

   (a) I have never seen this root word before.
   (b) I think I have seen this root word before, but I am not sure exactly what it means.
   (c) I have seen this root word before and I think it means_____.
   (d) I know this word. It means _____.
   (e) I can use this word in a sentence: _____ _____.

2. inter

   (a) I have never seen this root word before.
   (b) I think I have seen this root word before, but I am not sure exactly what it means.
   (c) I have seen this root word before and I think it means_____.
   (d) I know this word. It means _____.
   (e) I can use this word in a sentence: _____ _____.

3. mis

   (a) I have never seen this root word before.
   (b) I think I have seen this root word before, but I am not sure exactly what it means.
   (c) I have seen this root word before and I think it means_____.
   (d) I know this word. It means _____.

(e) I can use this word in a sentence: _____
_____.

4. semi

(a) I have never seen this root word before.
(b) I think I have seen this root word before, but I am not sure exactly what it means.
(c) I have seen this root word before and I think it means_____.
(d) I know this word. It means _____.
(e) I can use this word in a sentence: _____
_____.

5. terra

(a) I have never seen this root word before.
(b) I think I have seen this root word before, but I am not sure exactly what it means.
(c) I have seen this root word before and I think it means_____.
(d) I know this word. It means _____.
(e) I can use this word in a sentence: _____
_____.

6. port

(a) I have never seen this root word before.
(b) I think I have seen this root word before, but I am not sure exactly what it means.
(c) I have seen this root word before and I think it means_____.
(d) I know this word. It means _____.
(e) I can use this word in a sentence: _____
_____.

7. audi

(a) I have never seen this root word before.
(b) I think I have seen this root word before, but I am not sure exactly what it means.
(c) I have seen this root word before and I think it means_____.
(d) I know this word. It means _____.
(e) I can use this word in a sentence: _____
_____.

8. dict

   (a) I have never seen this root word before.
   (b) I think I have seen this root word before, but I am not sure exactly what it means.
   (c) I have seen this root word before and I think it means_____.
   (d) I know this word. It means _____.
   (e) I can use this word in a sentence: _____ _____.

9. meter

   (a) I have never seen this root word before.
   (b) I think I have seen this root word before, but I am not sure exactly what it means.
   (c) I have seen this root word before and I think it means_____.
   (d) I know this word. It means _____.
   (e) I can use this word in a sentence: _____ _____.

10. geo

   (a) I have never seen this root word before.
   (b) I think I have seen this root word before, but I am not sure exactly what it means.
   (c) I have seen this root word before and I think it means_____.
   (d) I know this word. It means _____.
   (e) I can use this word in a sentence: _____ _____.

11. spec/spect

   (a) I have never seen this root word before.
   (b) I think I have seen this root word before, but I am not sure exactly what it means.
   (a) I have seen this root word before and I think it means_____.
   (b) I know this word. It means _____.
   (c) I can use this word in a sentence: _____ _____.

12. hydro

(a) I have never seen this root word before.
(b) I think I have seen this root word before, but I am not sure exactly what it means.
(c) I have seen this root word before and I think it means_____.
(d) I know this word. It means _____.
(e) I can use this word in a sentence: _____ _____.

13. sub

(a) I have never seen this root word before.
(b) I think I have seen this root word before, but I am not sure exactly what it means.
(c) I have seen this root word before and I think it means_____.
(d) I know this word. It means _____.
(e) I can use this word in a sentence: _____ _____.

14. graph

(a) I have never seen this root word before.
(b) I think I have seen this root word before, but I am not sure exactly what it means.
(d) I have seen this root word before and I think it means_____.
(e) I know this word. It means _____.
(f) I can use this word in a sentence: _____ _____.

15. prim/prime

(a) I have never seen this root word before.
(b) I think I have seen this root word before, but I am not sure exactly what it means.
(c) I have seen this root word before and I think it means_____.
(d) I know this word. It means _____.
(e) I can use this word in a sentence: _____ _____.

16. omni

(a) I have never seen this root word before.
(b) I think I have seen this root word before, but I am not sure exactly what it means.
(c) I have seen this root word before and I think it means_____.
(d) I know this word. It means _____.
(e) I can use this word in a sentence: _____ _____.

17. micro

(a) I have never seen this root word before.
(b) I think I have seen this root word before, but I am not sure exactly what it means.
(g) I have seen this root word before and I think it means_____.
(h) I know this word. It means _____.
(i) I can use this word in a sentence: _____ _____.

18. anti

(a) I have never seen this root word before.
(b) I think I have seen this root word before, but I am not sure exactly what it means.
(c) I have seen this root word before and I think it means_____.
(d) I know this word. It means _____.
(e) I can use this word in a sentence: _____ _____.

APPENDIX F: MULITPLE CHOICE ASSESSMENT

Name: _____ Teacher:_____ Date:_____

Greek and Latin Root Words Pretest

Circle the answer that best describes the Greek and Latin root or root word.

1. co
   (a) in/into/on
   (b) together
   (c) up/above

2. inter
   (a) hidden/out-of-view
   (b) between/among
   (c) around

3. mis
   (a) wrong/bad
   (b) allowed/ok
   (c) understood

4. semi
   (a) large/powerful
   (b) individual
   (c) one-half/partly

5. terra
   (a) heaven
   (b) earth
   (c) religious

6. port
   (a) to close
   (b) to drop
   (c) to carry

7. audi
   (a) to speak
   (b) to move
   (c) to hear/listen

8. dict
   (a) to hear/listen
   (b) to say/speak
   (c) to write/scribe

9. meter
   (a) measure
   (b) write
   (c) ruler

10. geo
   (a) car
   (b) math
   (c) earth

11. spec/spect
   (a) look
   (b) small
   (c) special

12. hydro
   (a) fire
   (b) earth
   (c) water

13. sub
   (a) small
   (b) below
   (c) beside

14. graph
   (a) to speak/something spoken
   (b) to calculate/something calculated
   (c) to write/something written

15. prim/prime
   (a) first
   (b) medial
   (c) last

16. omni
   (a) workout
   (b) all/everything
   (c) celebrate

17. micro
(a) small
(b) talk
(c) first

18. anti
(a) around/somewhere
(b) across/not near
(c) against/opposite of

19. cohabitate
(a) to live in a space
(b) to live together in the same space
(c) to live above a space

20. interfamilial
(a) a family who is kept hidden
(b) cooperation between families
(c) being around families

21. misinform
(a) to inform incorrectly
(b) to inform correctly
(c) to understand the information

22. semisolid
(a) a powerful solid material
(b) a single solid material
(c) a partly solid material

23. terra-cotta
(a) a metal flower container
(b) a baked-earth flower container
(c) a plastic flower container

24. porter
(a) a person who lifts heavy things
(b) a person who drops many things; a klutz
(c) a person who carries luggage

25. audiology
(a) branch of science concerned with seeing
(b) branch of science concerned with hearing
(c) branch of science concerned with moving

26. contradict
(a) to hear someone talk
(b) to say the opposite of someone else
(c) to write carefully

27. barometer
(a) a tool that measures atmospheric pressure
(b) a tool that helps students write
(c) a tool that acts as a ruler

28. geocentric
(a) relating to a car
(b) relating to a math problem
(c) relating to the earth's center

29. spectator
(a) a person who watches a sports event
(b) a person who participates in a sports event
(c) a person who helps manage a sports event

30. hydrophobia
(a) a person afraid of fire
(b) a person afraid of the earth
(c) a person afraid of water

31. substandard
(a) a small standard
(b) falling below the standard
(c) located beside the standard

32. graphite
(a) a speaker used to amplify sound
(b) a tool used to calculate
(c) a carbon which can be used to write

33. primary
(a) first in time or development
(b) the middle in time or development
(c) the last in time or development

34. omniscient
(a) working out a part of your body
(b) knowing everything
(c) celebrating something

35. microscopic
(a) very small
(b) very talkative
(c) the first

36. antisocial
(a) one who enjoys being around people
(b) one who is afraid of people
(c) one who doesn't enjoy being around people

APPENDIX G: STUDENT INTERVIEW PROTOCOL

Name:_____ Date:_____

Teacher:_____ Interviewer:_____

Interview Protocol

Establishing Rapport

1. Tell me three words that describe you as a person.
2. What are some goals that you have for yourself?
3. What do you think is your best subject in school? Why?
4. What do you think is your worst subject in school? Why?
5. Can you describe the best thing that has happened to you in school so far for me?

Word Learning in General

1. Describe how you use the non-digital word wall.
2. Do you like using the non-digital word wall to learn words?
3. What do you like about using the non-digital word wall to learn words?
4. What do you not like?
5. Describe how you use the digital word wall.
6. Do you like using the digital word wall to learn words?
7. What do you like about using the digital word wall?
8. What do you not like about using the digital word wall?
9. How do you like to learn the meanings of words (the digital or non-digital) why?
10. What strategies work best for you when you're learning vocabulary words?

Engagement and Motivation

1. Do you use computers at home?
2. How do you use the computer at home?
3. Do you find it fun?
4. What made using the computer at home fun?
5. What websites do you go to at home?
6. How long do you stay on the computer?
7. How do you use the computer at school?
8. Do you find using the computer at school fun? If so, why?
9. What websites do you go on at school?
10. Have there been any problems on the computer?
11. If you have a problem, who helps you at home? At school?

Conclusion

1. What has been the absolute best thing about learning words?
2. Is there anything else you'd like to tell me before we finish?

APPENDIX H: TEACHER INTERVIEW PROTOCOL

Name:_____ Date:_____

Interviewer:_____

Interview Protocol

Establishing Rapport

1. Tell me three words that describe you as a person.
2. What are some goals that you have for yourself?
3. What do you think is your strongest area of expertise? Why?
4. What do you think is your weakest area of expertise? Why?

Word Learning in General

1. Describe how you used the interactive word wall.
2. Describe how you used the digital word wall.
3. Do you like using the digital word wall to teach Greek and Latin roots?
4. How have you previously taught Greek and Latin roots?
5. Do you feel as though the students were engaged and excited about learning the Greek and Latin roots when you taught with this traditional method?

Engagement and Motivation

1. Do you use computers in other areas of teaching? Where? How?
2. Do students seem more responsive when computers and/or the Internet is involved?
3. Do you find it fun and/or exciting teaching in this manner? Why or why not?
4. What are the drawbacks to teaching with digital tools?
5. What websites do you use at school? Do you think you will continue to use the digital word wall? Why or why not?
6. How long do you estimate that your students use computers throughout the day?
7. Do you find that students get more work done when they are working on the computer?
8. Do you notice increased engagement or would you categorize it as a distracting tool? Please explain.
9. What have been the largest problems on the computer?

Conclusion

1. What has been the absolute best thing about teaching Greek and Latin roots?
2. Is there anything else you'd like to tell me before we finish?

APPENDIX I: IMPLEMENTATION FIDELITY

Date:_____
Teacher:_____
Observer:_____

Implementation Fidelity
Checklist for Non- Digital Word Wall

The teacher is:

___ Using the flipcharts (similar to a powerpoint, but through the interactive white board) that the researcher created, to introduce the three Greek and Latin roots for the week.

___ Posting the provided 3x5 index cards with the root and meaning for all three roots.

___ Providing students (in collaborative groups of 4-6) with dictionaries.

___ Allowing time for students to find words containing the Greek and Latin roots (approximately 10-20 minutes) and create modified Frayer models (one for each root).

___ Allowing students time to present each modified Frayer model.

___ Having the students present the modified Frayer model in the following manner, "Our root is_____. The meaning of our root is _____. Our example is _____. Our sentence is _____. Our illustration is _____." For example, "Our root is co. The meaning of our root is together. Our example is cooperate. Our sentence is: the two friends cooperated on a big project in school. Our illustration is of two friends girls leaning over a table and working on a project."

___ Wrapping up the lesson by going over the meaning of each root once more.

___ Posting the modified Frayer models in a visible place in the classroom for students to see; close to the 3x5 index cards with the root and meaning. In effect, all "co" modified Frayer models should be clustered around the "co" 3x5 index card with the meaning and root.

Date:_____
Teacher:_____
Observer:_____

Implementation Fidelity
Checklist for Digital Word Wall

The teacher is:

___ Using the flipcharts (similar to a powerpoint, but through the interactive white board) that the researcher created, to introduce the three Greek and Latin roots for the week.

___ Posting the provided 3x5 index cards with the root and meaning for all three roots.

___ Providing students (in collaborative groups of 4-6) with laptop or desktop computers.

___ Allowing time for students to find words containing the Greek and Latin roots (approximately 10-20 minutes) and create digital modified Frayer models (one for each root). Students will save these digital modified Frayer models to the digital word wall (the wiki).

___ Pulling up the students' digital Frayer models on the interactive white board and allowing students time to present each digital modified Frayer model.

___ Having the students present the digital modified Frayer model in the following manner, "Our root is_____. The meaning of our root is _____. Our example is _____. Our sentence is _____. Our illustration is _____." For example, "Our root is co. The meaning of our root is together. Our example is cooperate. Our sentence is: the two friends cooperated on a big project in school. Our illustration is of two friends girls leaning over a table and working on a project."

___ Wrapping up the lesson by going over the meaning of each root once more.